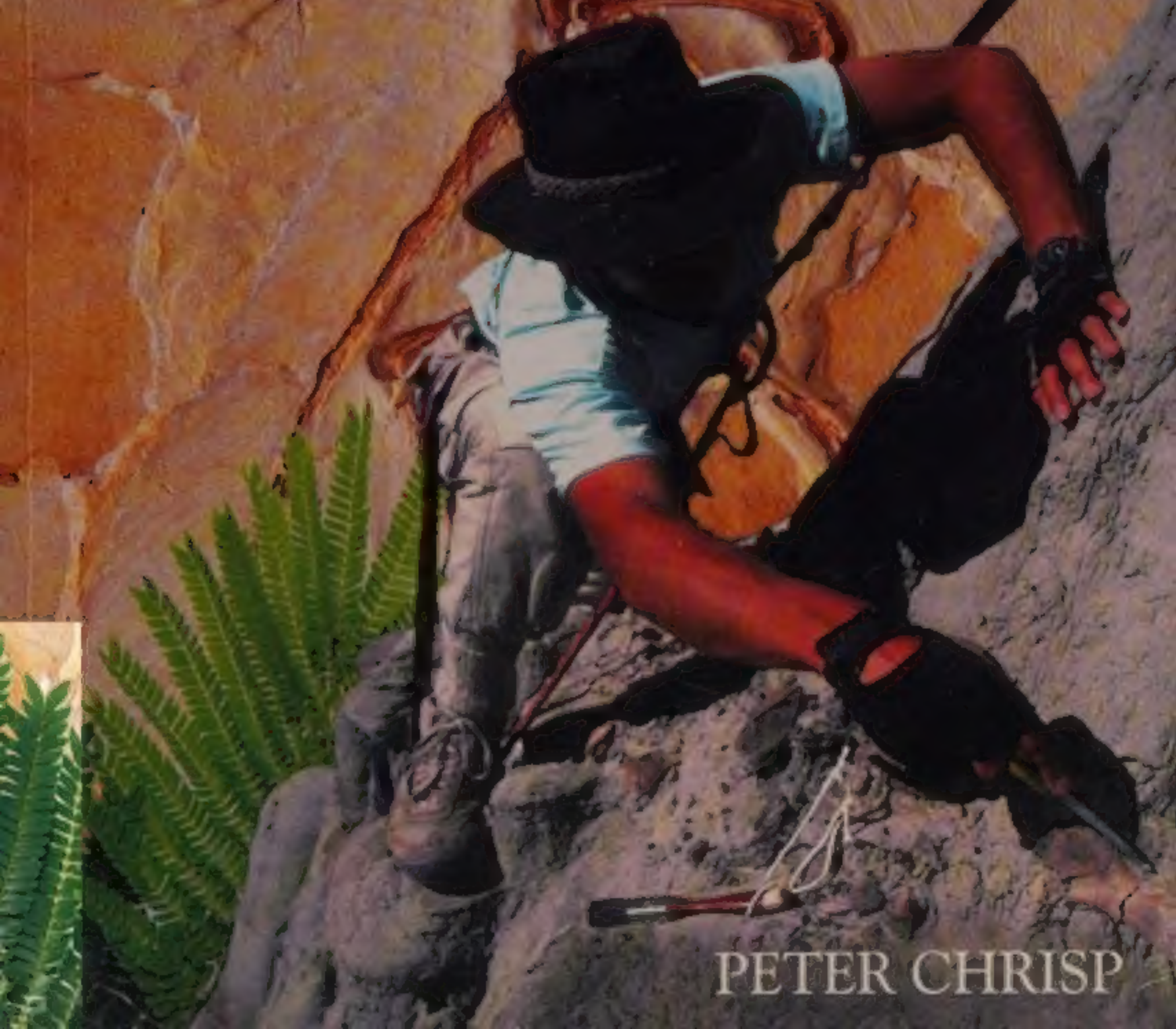


 READERS

PROFICIENT  
**4**  
READERS

# Dinosaur Detectives



PETER CHRISP



# READERS

## Level 3

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Shark Attack!  
Titanic  
Invaders from Outer Space  
Movie Magic  
Time Traveler  
Bermuda Triangle  
Tiger Tales  
Zeppelin: The Age of the Airship  
Spies  
Terror on the Amazon  
Disasters at Sea  
The Story of Anne Frank  
Abraham Lincoln: Lawyer, Leader, Legend  
George Washington: Soldier, Hero, President  
Extreme Sports  
Spiders' Secrets  
The Big Dinosaur Dig  
Space Heroes: Amazing Astronauts  
The Story of Chocolate  
School Days Around the World  
Polar Bear Alert!  
Welcome to China  
My First Ballet Show  
Ape Adventures

Greek Myths  
MLB: Home Run Heroes: Big Mac, Sammy, and Junior  
MLB: World Series Heroes  
MLB: Record Breakers  
MLB: Down to the Wire: Baseball's Great Pennant Races  
Star Wars: Star Pilot  
Star Wars: I Want to Be a Jedi  
Star Wars: The Story of Darth Vader  
Star Wars: Yoda in Action  
Star Wars: Forces of Darkness  
Marvel Heroes: Amazing Powers  
The X-Men School  
Abraham Lincoln: Abogado, Líder, Leyenda *en español*  
Al Espacio: La Carrera a la Luna *en español*  
Fantastic Four: The World's Greatest Superteam  
Pokemon: Become a Pokemon Trainer  
Wolverine: Awesome Powers  
Iron Man: Friends and Enemies

## Level 4

---

Volcanoes and Other Natural Disasters  
Pirates! Raiders of the High Seas  
Micromonsters  
Going for Gold!  
Extreme Machines  
Flying Ace: The Story of Amelia Earhart  
Black Beauty  
Free at Last! The Story of Martin Luther King, Jr.  
Joan of Arc  
Spooky Spinechillers  
Welcome to The Globe! The Story of Shakespeare's Theater  
Space Station: Accident on Mir  
Atlantis: The Lost City?  
Dinosaur Detectives  
Danger on the Mountain: Scaling the World's Highest Peaks  
Crime Busters  
The Story of Muhammad Ali  
First Flight: The Story of the Wright Brothers  
D-Day Landings: The Story of the Allied Invasion  
Solo Sailing  
Thomas Edison: The Great Inventor  
Dinosaurs! Battle of the Bones  
Skate!  
MLB: Strikeout Kings  
MLB: Super Shortstops: Jeter, Nomar, and A-Rod  
MLB: The Story of the New York Yankees  
MLB: The World of Baseball  
MLB: October Magic: All the Best World Series!  
JLA: Batman's Guide to Crime and Detection

JLA: Superman's Guide to the Universe  
JLA: Aquaman's Guide to the Oceans  
JLA: Wonder Woman's Book of Myths  
JLA: Flash's Book of Speed  
JLA: Green Lantern's Book of Inventions  
The Story of the X-Men: How it all Began  
Creating the X-Men: How Comic Books Come to Life  
Spider-Man's Amazing Powers  
The Story of Spider-Man  
The Incredible Hulk's Book of Strength  
The Story of the Incredible Hulk  
Transformers: The Awakening  
Transformers: The Quest  
Transformers: The Unicron Battles  
Transformers: The Uprising  
Transformers: Megatron Returns  
Transformers: Terrorcon Attack  
Star Wars: Galactic Crisis!  
Star Wars: Beware the Dark Side  
Star Wars: Epic Battles  
Star Wars: Jedi Adventures  
Marvel Heroes: Greatest Battles  
Fantastic Four: Evil Adversaries  
Graphic Readers: The Price of Victory  
Graphic Readers: The Terror Trail  
Graphic Readers: Curse of the Crocodile God  
Graphic Readers: Instruments of Death  
Graphic Readers: The Spy-Catcher Gang  
Graphic Readers: Wagon Train Adventure  
Los Asombrosos Poderes de Spider-Man *en español*  
La Historia de Spider-Man *en español*  
Wolverine: The Story of Wolverine  
The Rise of Iron Man



## A Note to Parents and Teachers

DK READERS is a compelling reading programme for children. The programme is designed in conjunction with leading literacy experts, including Cliff Moon M.Ed., who has spent many years as a teacher and teacher educator specializing in reading. Cliff Moon has written more than 160 books for children and teachers. He is series editor to Collins Big Cat.

Beautiful illustrations and superb full-colour photographs combine with engaging, easy-to-read stories to offer a fresh approach to each subject in the series. Each DK READER is guaranteed to capture a child's interest while developing his or her reading skills, general knowledge, and love of reading.

The five levels of DK READERS are aimed at different reading abilities, enabling you to choose the books that are exactly right for your child:

**Pre-level 1:** Learning to read

**Level 1:** Beginning to read

**Level 2:** Beginning to read alone

**Level 3:** Reading alone

**Level 4:** Proficient readers

The “normal” age at which a child begins to read can be anywhere from three to eight years old. Adult participation through the lower levels is very helpful for providing encouragement, discussing storylines, and sounding out unfamiliar words.

No matter which level you select, you can be sure that you are helping your child learn to read, then read to learn!







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READERS



# DINOSAUR DETECTIVES

Written by Peter Chrisp



A Dorling Kindersley Book



# Dinosaur detectives

Long, long ago, people all over the world began finding huge bones buried in sand or stone. Sometimes, these findings gave rise to stories about giants and dragons.

Today, we know these bones belonged to enormous beasts who lived millions of years ago. Some of them were land reptiles, called dinosaurs. Dinosaurs walked the Earth for over 160 million years.



**Mary Anning**  
*One of the first fossil hunters, she discovered her first prehistoric creature when she was just 11 years old.  
See page 6.*



**Gideon Mantell**  
*This English doctor found a huge tooth. It led him on the trail of a beast he called Iguanodon.  
See page 14.*



**Richard Owen**  
*This brilliant scientist invented the word "dinosaur", and held a party inside a concrete model of one.  
See page 20.*





The dinosaurs died out  
65 million years ago.

In this book, you can read about  
some of the people who first  
discovered the truth about these  
huge bones. Like detectives, they  
worked to collect evidence and put  
together clues.

What they learned gives us a  
picture of life in the far distant past,  
when our world was the home of  
the dinosaurs.



**Othniel Marsh**  
*This rich American  
and his rival Edward  
Cope hunted for  
fossils in the Wild  
West. They  
discovered and  
named many new  
kinds of dinosaur.  
See page 28.*



**Werner Janensch**  
*This German scientist traveled to  
Africa to dig for dinosaurs. What  
he discovered changed the way we  
see our world.  
See page 34.*



**Jack Horner**  
*This American scientist dug up  
dozens of dinosaur nests, many  
still containing eggs and babies.  
See page 40.*





### Fossils

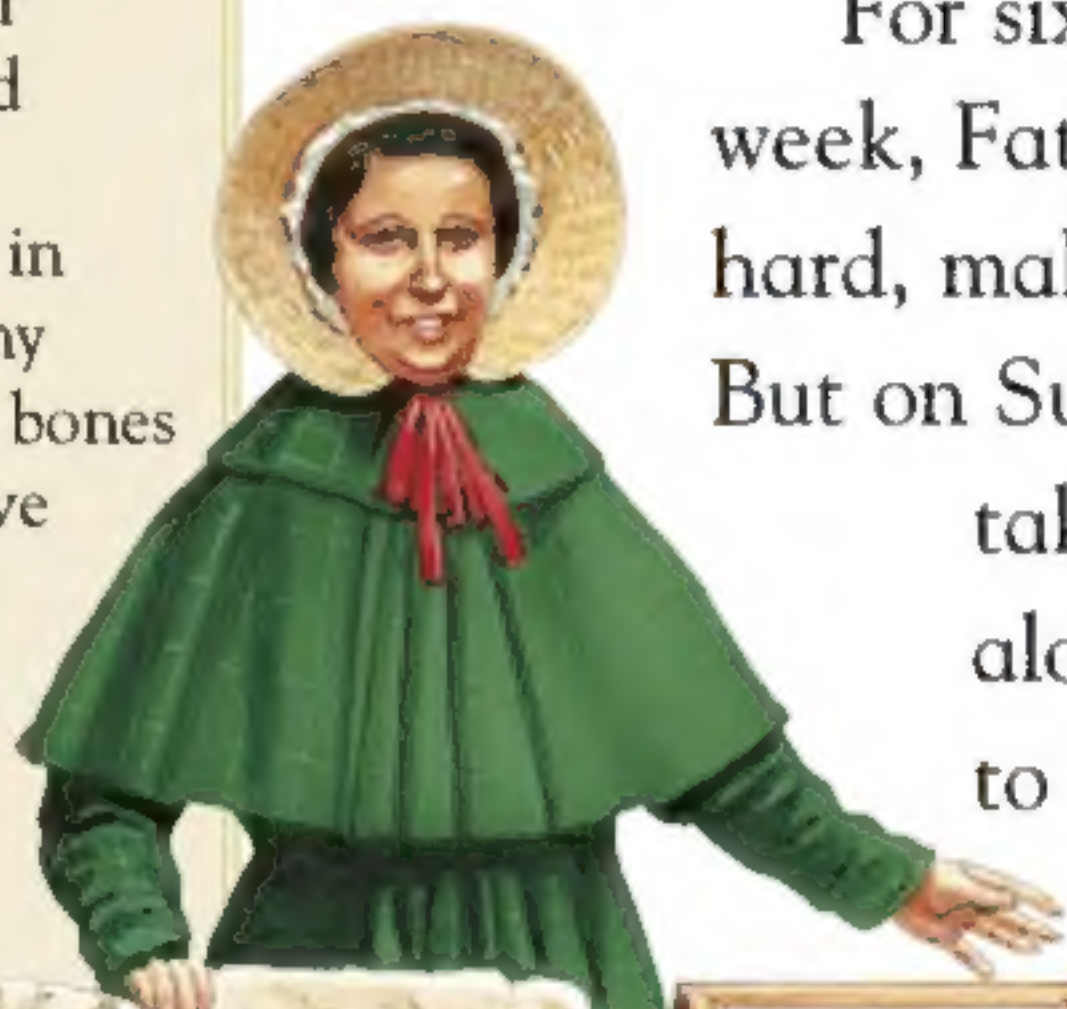
Fossils are the remains of plants and animals, preserved in rock. Many fossils are bones which have gradually turned to stone.

# The fossil woman

Welcome to my fossil shop!

My name is Mary Anning. I've lived here in Lyme Regis all my life. I was born in 1799 above this very shop, where my father was a carpenter.

For six days of the week, Father worked hard, making furniture. But on Sundays, he would take me for walks along the beaches to look for fossils.





He sold them to the ladies and gentlemen who come to the seaside every summer.

Father taught me how to tap a rock in just the right place with a hammer, to make it split open.

Often there would be nothing inside it. But sometimes we would find the skeleton of a beautiful fish, or a curly shell. We call the shells “snakestones” because they look like curled up snakes. Scientists call them ammonites.

The best time to find fossils is after a storm, when the wind and waves batter and chip away at the cliffs. When a storm hits Lyme Regis, all sorts of strange creatures just fall out of the cliffs.

Father said that we were “fishing for curiosities.” It was a bit like fishing because we never knew what we would catch. But our “fish” were made of stone.



### **Lyme Regis**

Lyme Regis, on the south coast of England, is still one of the best places in the world to find fossils.

### **Fossil seller**

Mary Anning (1799–1847) was the first person to make a living by selling fossils.



### **Ammonites**

These ancient relatives of the squid lived in the sea and caught food with their tentacles.





### Fishing

Many people in Lyme Regis made their living from fishing in the sea.



### Tools

Mary used simple tools, like this hammer and chisel, to split open rocks and chip out fossils.

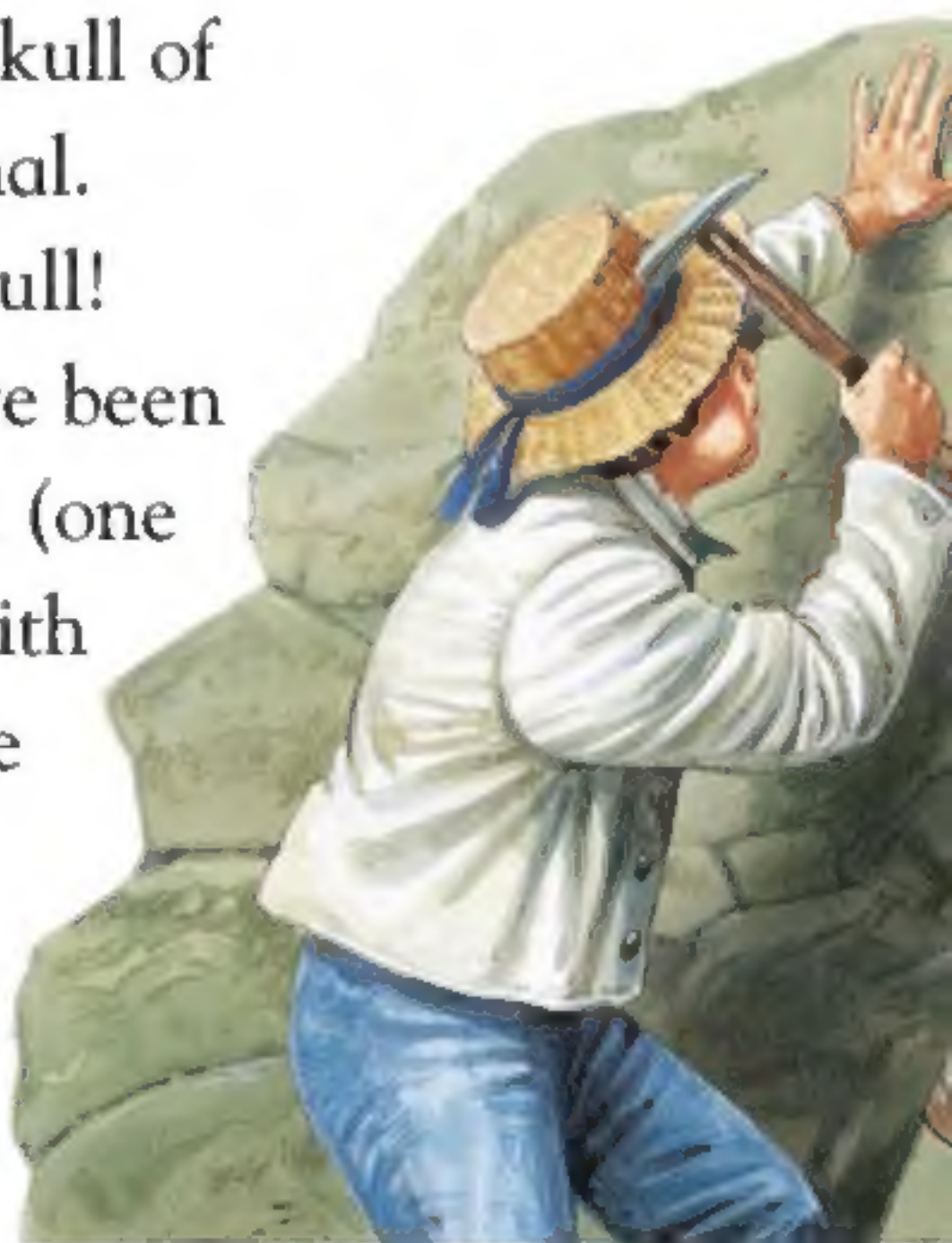
My poor father died in 1810, when I was just ten years old. Mother made some money by selling fish, but it was not enough for us to live on.

I knew that I had to work to help feed my family. I decided that I would spend all my time looking for curiosities to sell.

One day, I was looking for fossils with my brother Joseph. Walking along the beach, I looked at the cliff and saw something wonderful staring back at me.

It was the skull of a strange animal. And what a skull!

It must have been about four feet (one meter) long, with a big round eye hole and jaws stuffed with sharp teeth.





“It’s a sea dragon, Mary!” said Joseph excitedly.

We hammered at the rocks until we could free the skull. Although it was very heavy, we managed to carry it home.

Joseph and I looked at pictures of animals in a book, to see if we could discover what it was. We decided that it must be a crocodile.

**Seashells**  
Mary’s fossil discoveries made her famous. The tongue twister, “She sells seashells on the sea shore” is thought to refer to her.





## Geology

Geology, the study of the Earth and its rocks, was a new science in Mary's time.

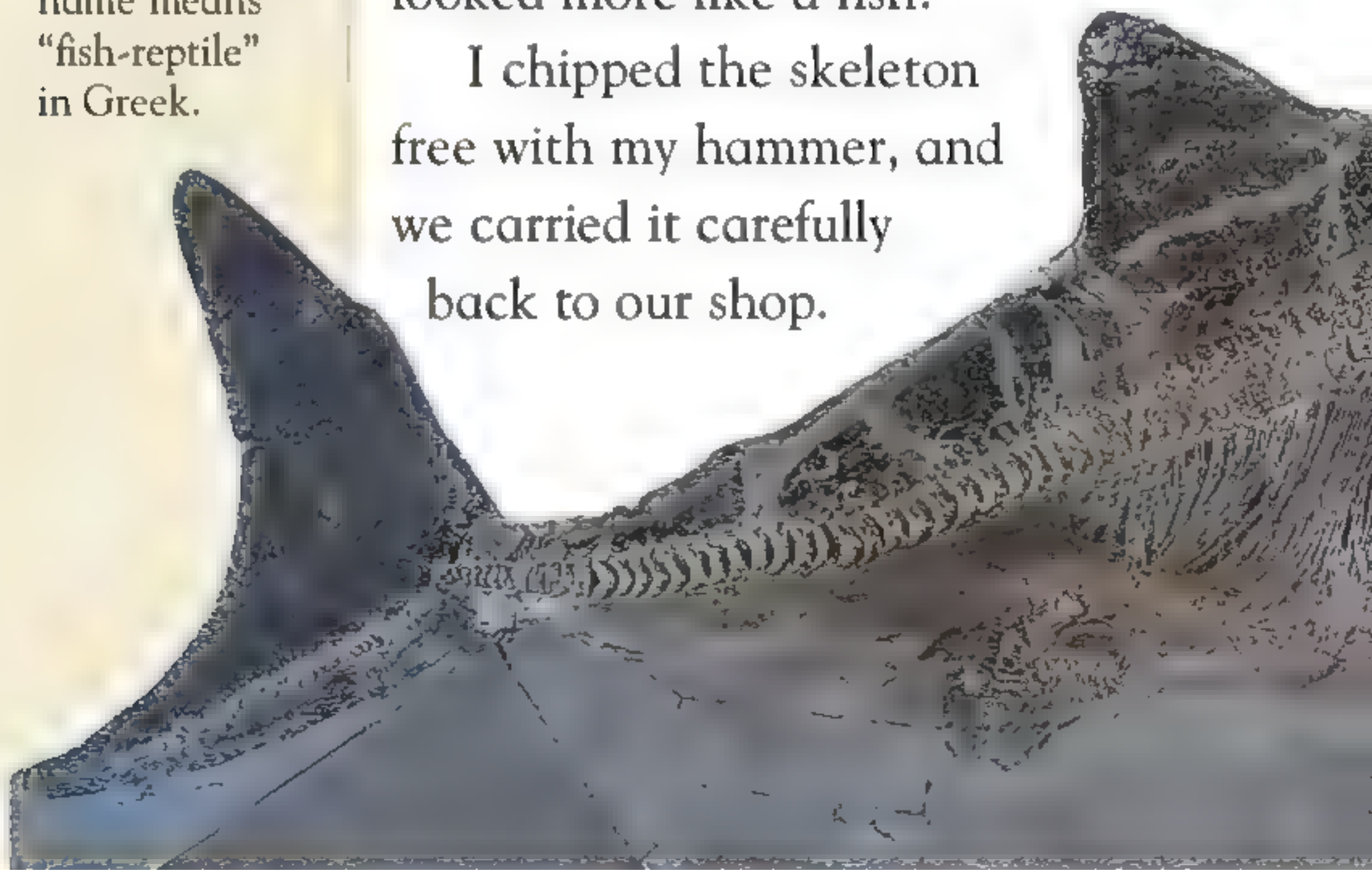
I was sure that the rest of the crocodile was still there, buried in the cliff. All I had to do was wait for another rock slide. So after every storm, I would go back to the spot where we found the skull, hoping to see the rest of the skeleton.

It was almost a year later, in 1812, that the rocks finally fell away. There was my creature! But it wasn't a crocodile. Instead of legs, this animal had short paddles. It looked more like a fish!

I chipped the skeleton free with my hammer, and we carried it carefully back to our shop.

### *Ichthyosaurus*

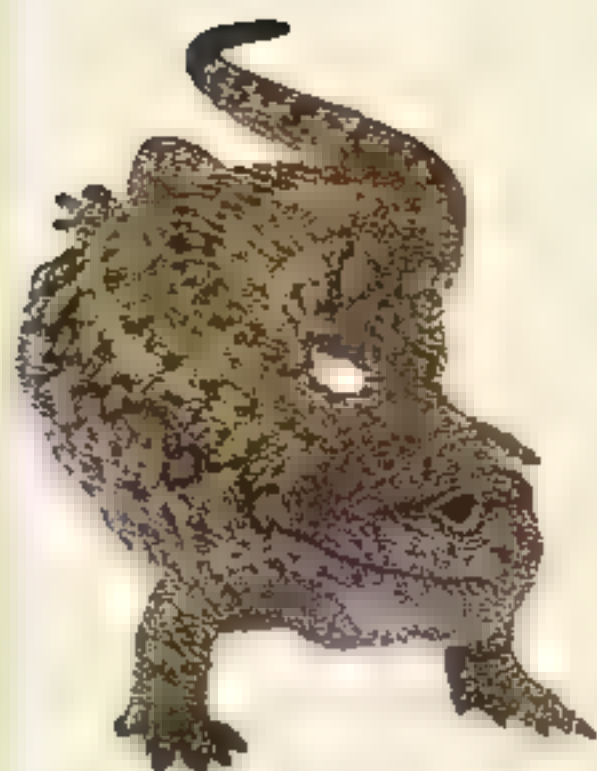
This creature's name means "fish-reptile" in Greek.





News quickly spread that the Annings had found a “sea dragon.” Everyone wanted to have a look, and we were able to charge visitors some money to see it. Then we sold the skeleton to a local nobleman for £23 – more money than I’d ever seen before.

At this time, I met my first geologists – scientific gentlemen who came to see the creature and argue about what it was. One of these geologists, Mr. König, gave my creature a name: *Ichthyosaurus*.



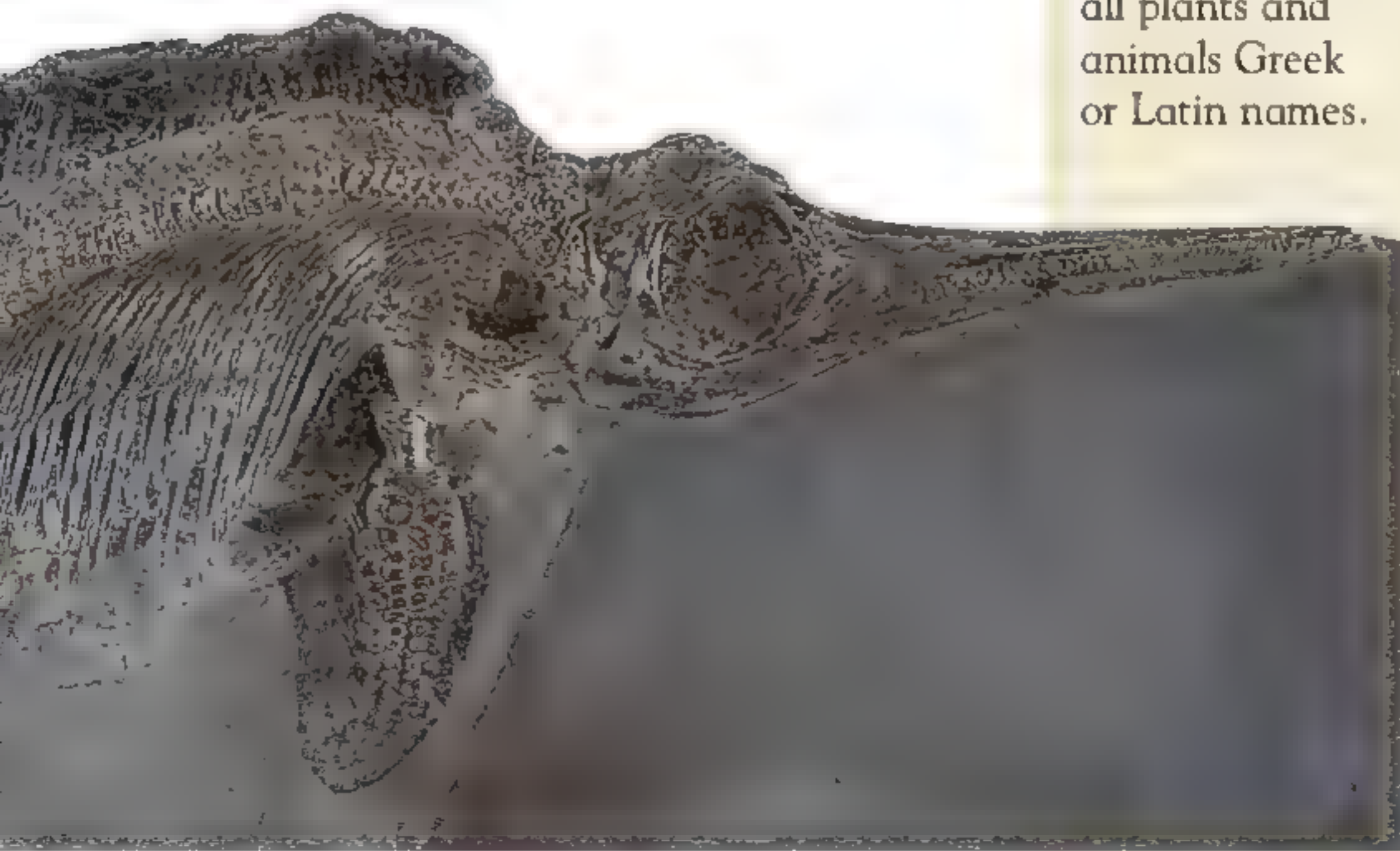
### Reptiles

Reptiles are the group of animals that includes lizards and snakes.

*Ichthyosaurus* was a reptile that swam like a fish.

### Naming

Scientists gave all plants and animals Greek or Latin names.







### Artist's view

This etching from Mary's time shows the sea swarming with ichthyosaurs and plesiosaurs.

### Sold for £100

In Mary's time, £100 was a huge sum of money. An ordinary family of five would be lucky to earn £1 in a week. Many people earned much less.

When I was 22, I found an even stranger creature in the cliffs. It had a tiny head, an amazingly long neck, and four flippers.

It took me months to chip it free from the rocks, but it was time well spent. I was able to sell it to the Duke of Buckingham for £100.

I showed the skeleton to a geologist called Mr. Conybeare, who visited me. His mouth dropped open in astonishment.

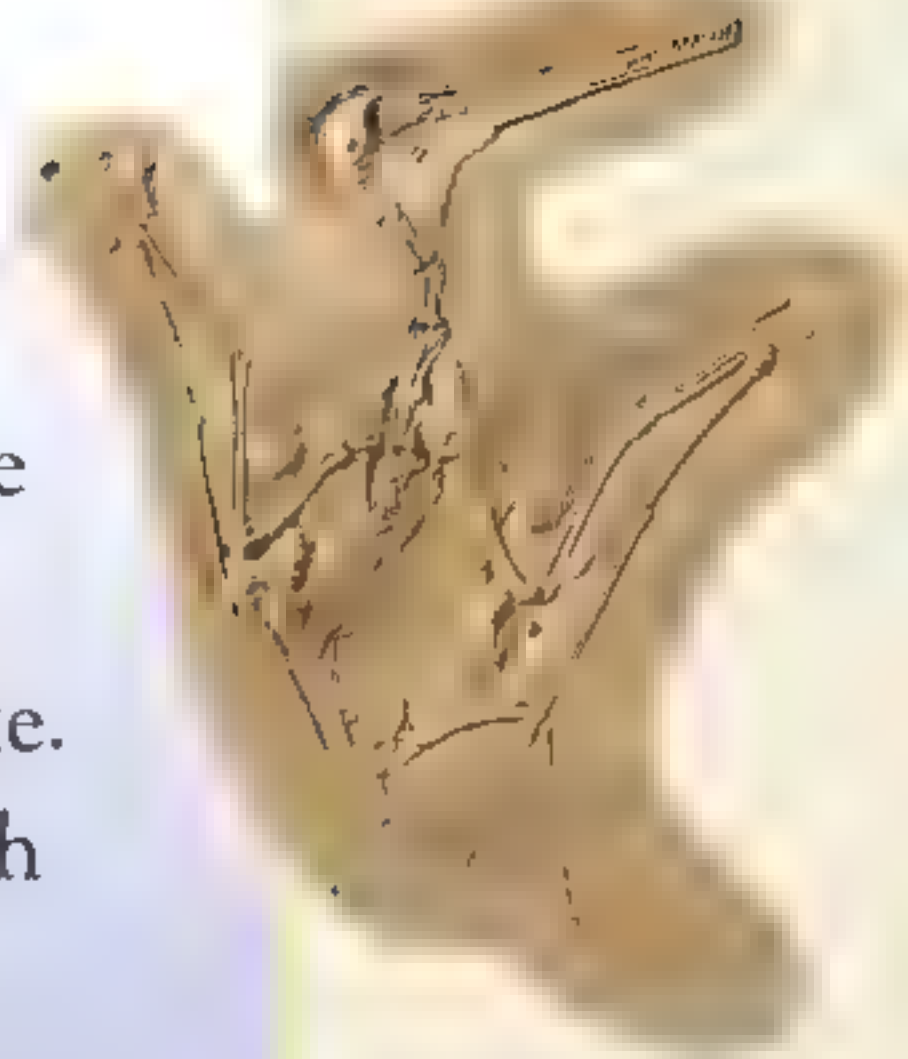


“I have never seen anything like this before!” he said. “It has the head of a turtle and the paddles of a whale. But its neck is like a giant snake. I shall call it *Plesiosaurus*, which means ‘almost a reptile’.”

*Plesiosaurus* made me famous, although some geologists accused me of having created a fake fossil to make money.

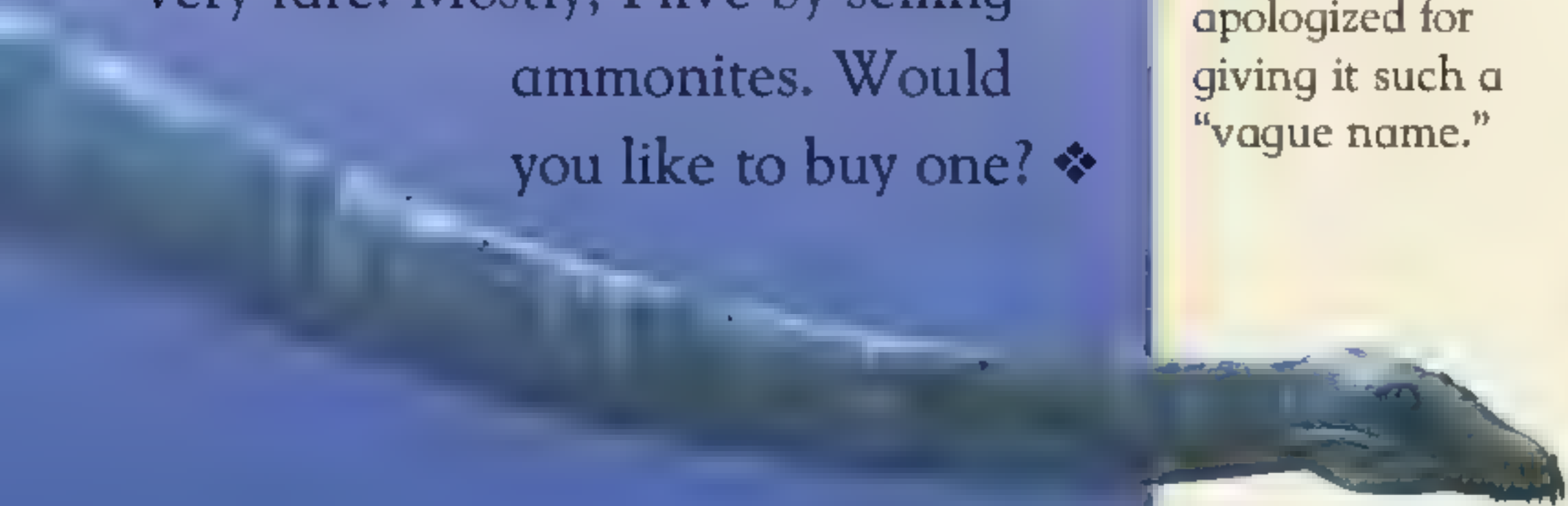
Then last year, I discovered a reptile with wings! A fossil expert called Professor Buckland has named it *Pterodactylus macronyx*. He says that the poor beast must have drowned in the sea.

Of course, finds such as these are very rare. Mostly, I live by selling ammonites. Would you like to buy one? ❖



**Flying reptiles**  
Pterosaurs were flying reptiles which lived at the same time as the dinosaurs.

**“Almost a reptile”**  
William Conybeare published a description of the *Plesiosaurus* in 1821. He apologized for giving it such a “vague name.”







**Busy doctor**  
Gideon Mantell  
(1790–1852)  
visited up to  
60 patients a  
day. But he still  
found time to  
collect fossils  
and write a  
book called  
*The Geology  
of Sussex*.

**Mrs. Mantell**  
Mary Ann  
eventually lost  
patience with  
her husband's  
hobby. She left  
Gideon when  
his fossil  
collection took  
over their  
whole house!

## The strange tooth

Ladies and gentlemen, thank you for coming to my lecture! My name is Gideon Mantell. Today, I am going to tell you about a remarkable discovery that I made in 1822.

At the time, I was a doctor in the English county of Sussex. Although I practiced medicine, my real interest was in geology. Between visits to patients, I would always find time to collect fossils.

One spring day, I was visiting a patient with my wife, Mary Ann. She had come with me to enjoy the fine weather. While I was busy, she strolled down the lane and saw a pile of rocks, used by workmen to repair the roads.

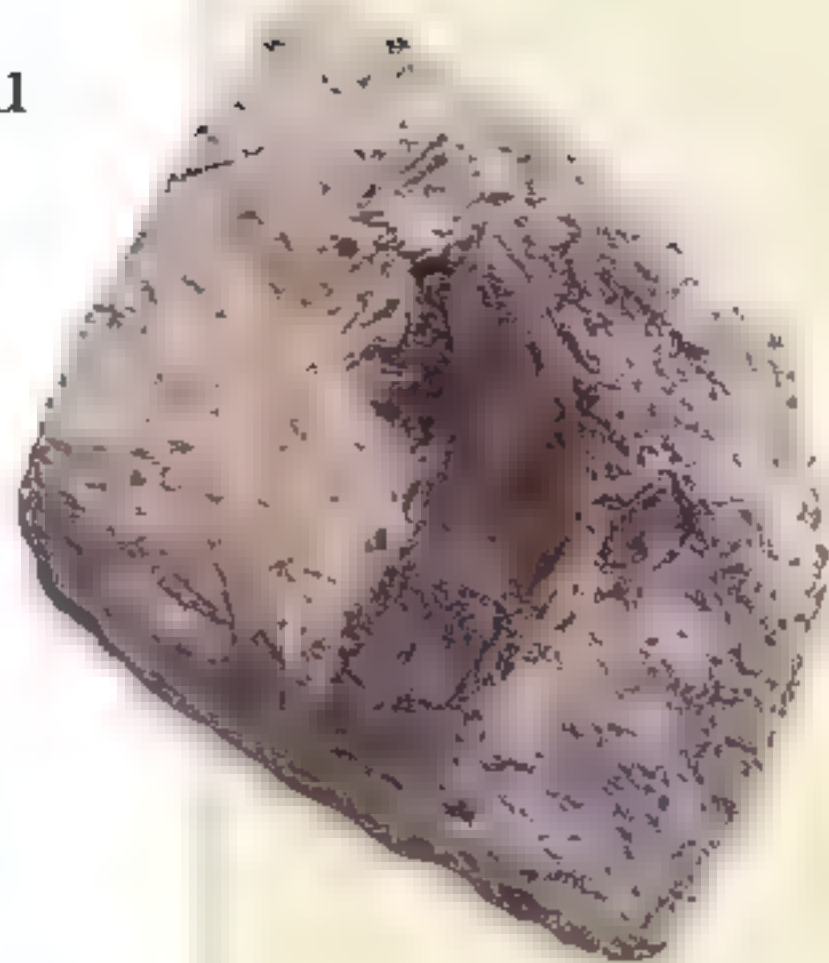
In one of the rocks, my wife noticed something brown and shiny. Looking closely, she saw that it was a very large tooth.





And here is that tooth! As you can see, it is worn away on the side from chewing, like the tooth of a plant-eating mammal. But it is an odd shape, with ridges. I had never seen anything like it.

The workmen took me to the quarry, where I was amazed to learn that the tooth had come from a very old layer of rocks. No mammal fossil has ever been found in such rocks.



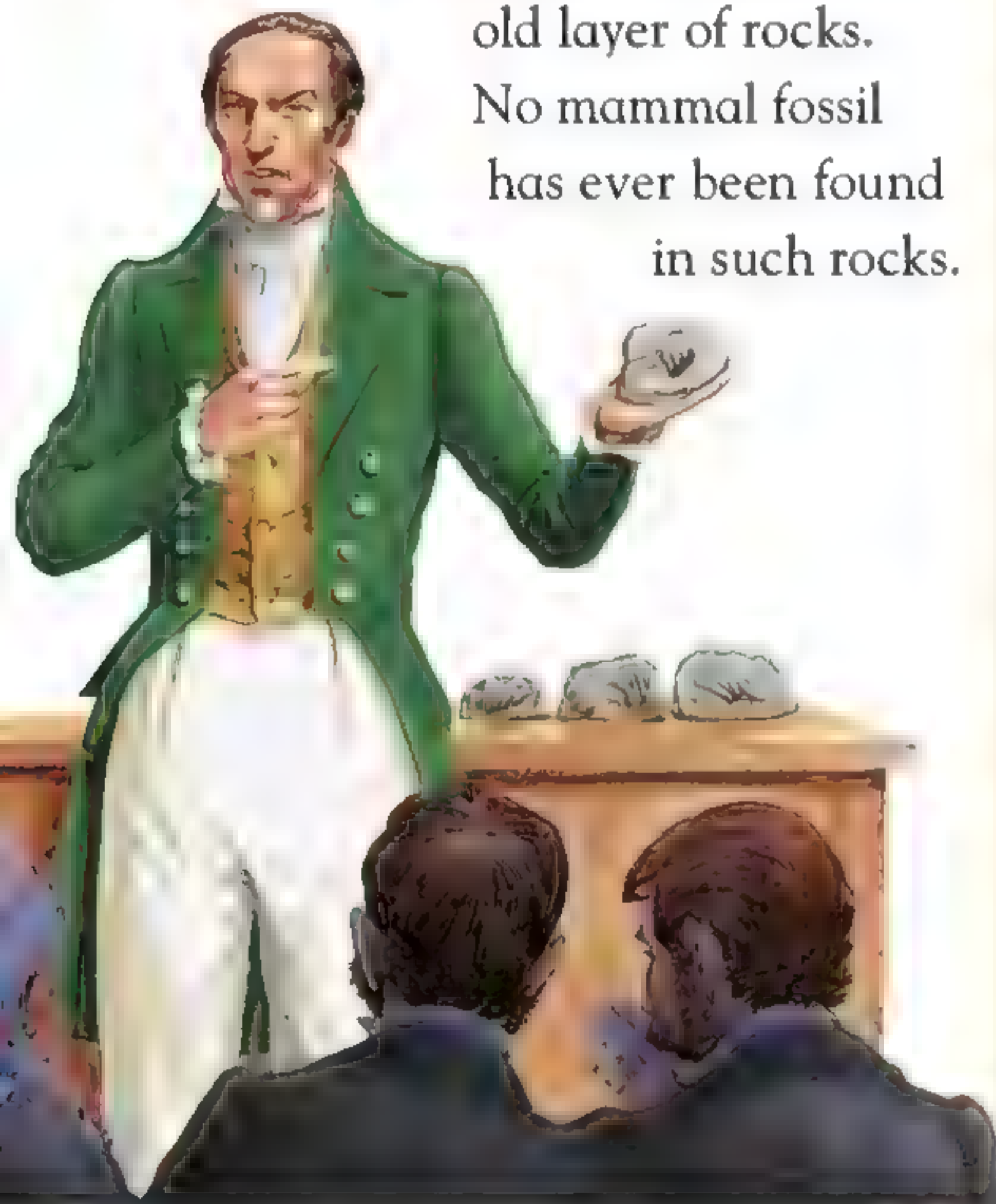
*A fossilised  
Iguanodon tooth*

### **Teeth**

Tooth shapes show what an animal eats. Plant-eaters have short teeth for chopping and chewing leaves. Meat-eaters have sharp, jagged teeth.

### **Rock layers**

Different types of fossils are found in different layers of rock. The oldest layers are the lowest in a rock face.







**Buckland**  
William Buckland was the scientist who named Mary Anning's pterosaur.

**Eccentric**  
Buckland kept a pet bear and often did chicken impressions in the middle of his lectures!

**Clever horse**  
Buckland's horse always stopped when she passed a quarry. She wouldn't move until he got off and looked for fossils.

I knew of one man who might be able to help me solve the mystery of the tooth. Only Professor Buckland has a bigger collection of fossils than I do. He has spent years collecting them from quarries around England.

I traveled to the professor's home in Oxford, and showed him the enormous tooth.

"Remarkable, sir!" said Buckland. "I fear I cannot help you to identify it. But let me show you a fossil!"

He led me to his desk, piled high with a jumble of rocks. Buckland pulled out a large bone and handed it to me.

I could see that it was a jaw, for it held a long, sharp, curved tooth. "It looks like a flesh eater," I said, "a very big flesh eater!"





“It was found in a slate quarry not far from here,” said Buckland. “As you will observe, it is shaped like a lizard’s jaw. Yet from the size of the tooth, this lizard must have been more than 40 feet (12 meters) long.

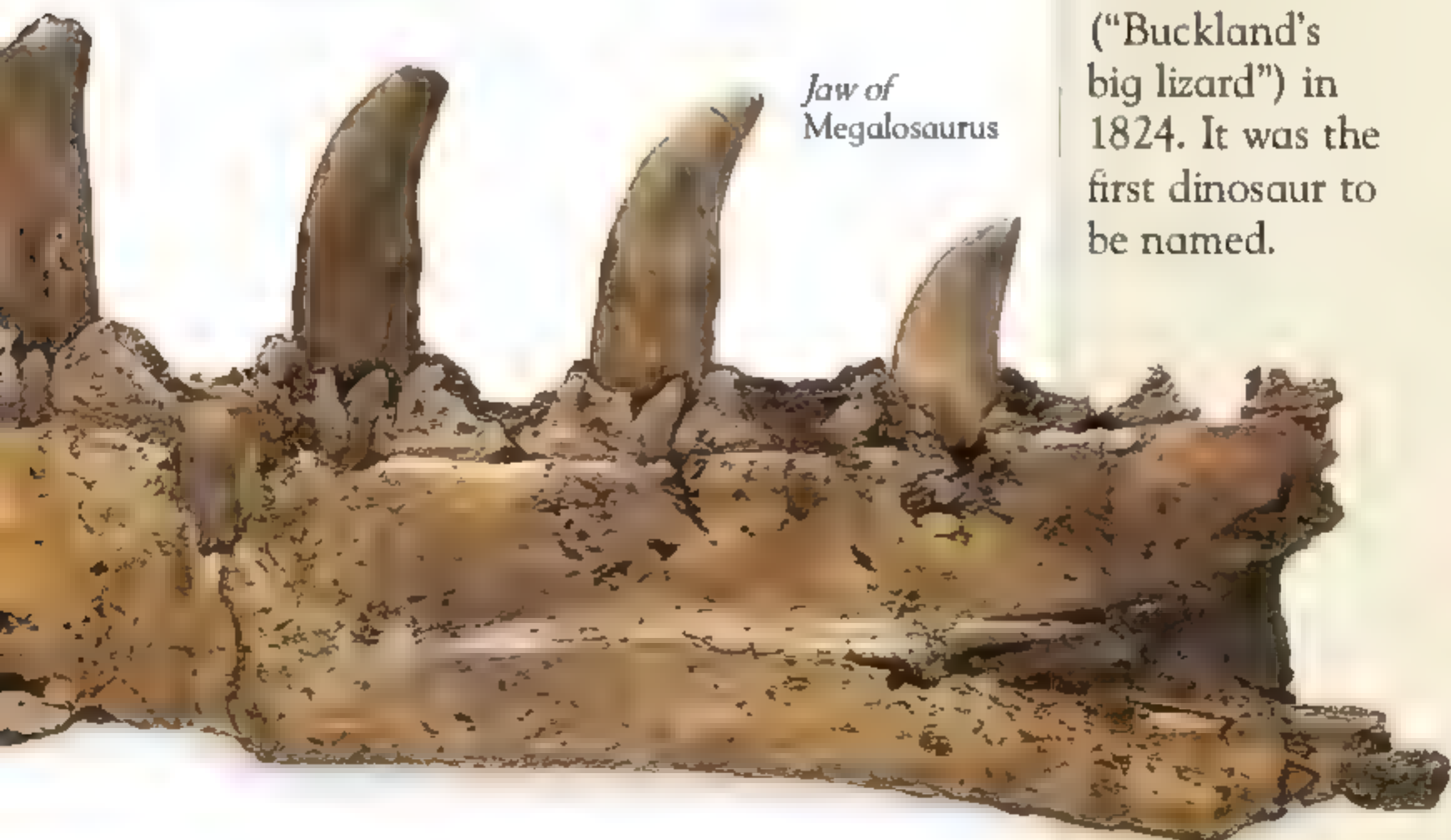
Think of that, sir – a 40-foot (12-meter) long flesh-eating lizard roaming around Oxfordshire!” I shuddered at the thought of it.

The professor went on, “I am going to call this great lizard a *Megalosaurus*.”



*Megalosaurus*  
Buckland published a description of *Megalosaurus bucklandii* (“Buckland’s big lizard”) in 1824. It was the first dinosaur to be named.

*Jaw of  
Megalosaurus*







### Age of reptiles

In 1838, Mantell published a book called *The Wonders of Geology*. It included this picture of a *Megalosaurus* attacking an *Iguanodon*.

### Strange meals

Buckland was famous for eating unusual animals.

He always said that a mole was the most revolting thing he had ever tasted – until he ate a bluebottle!



Buckland invited me to stay for dinner, but I made excuses and left. I had heard that the professor ate odd things, like hedgehog meat.

As I traveled home, I thought about Buckland's discovery. I already knew of the giant sea reptiles discovered by Miss Anning at Lyme Regis. Now Buckland had found a huge land reptile.

Perhaps my tooth also came from an ancient reptile. Was it possible, I wondered, that before the time of the mammals, there had been an age of reptiles?

I found my next clue in 1825, at the museum of the Royal College of Surgeons in London.





Looking through the collection of skeletons, I came across a South American lizard called an iguana. Its teeth were shaped just like the one I had found, with the same ridges. The only difference was that my tooth was 20 times bigger.

This convinced me that I had indeed found a reptile. I decided to call my reptile *Iguanodon*, or “iguana tooth.” ❖



**Iguana**  
The South American iguana grows up to five feet (1.5 meters) long. Mantell pictured his *Iguanodon* like an iguana, but 20 times bigger.



***Iguanodon***  
Mantell published his description of *Iguanodon* in 1825. It was the second dinosaur to be named.





### Skeleton expert

Richard Owen was able to study many different skeletons by cutting up animals that died at London Zoo.

### Crowd-pleaser

In 1854, huge crowds went to the Crystal Palace in London, to see the concrete models of *Iguanodon* and *Megalosaurus*.

### Exhibition

Owen's models were the world's first dinosaur exhibition.

## Dinner in a dinosaur

I will never forget the party I went to in London on New Year's Eve in 1853. We ate our dinner inside an *Iguanodon*!

It was not a flesh-and-blood *Iguanodon*, of course. It was a brick and concrete model, built to show the public what these remarkable beasts might have looked like.

My name is Prestwick and, like most of the guests on that evening, I'm a geologist.

At the head of the table sat our host, Professor Richard Owen, an expert on animal skeletons. He had designed the splendid creature in which we sat.





Owen rose to his feet and said,  
“Fellow scientists! Let us drink to  
the memory of Gideon Mantell,  
discoverer of *Iguanodon*!”

We raised our glasses and cried:  
“Mantell!” There was a brief silence,  
as we each remembered the good  
doctor, who had died the previous  
year. It was sad indeed that Mantell  
was not there, to see his discovery  
brought to life.



Thumb

Nose horn?  
The concrete  
*Iguanodon* had  
a horn on its  
nose. Mantell  
and Owen  
had both  
misunderstood  
this bone. It  
was really the  
dinosaur's  
thumb!







**Straight legs**  
Straight legs are better at bearing weight than the sprawling legs of lizards. It was thanks to their straight legs that dinosaurs could grow so much bigger than any other reptiles.

As midnight approached, my friend Professor Forbes thanked our host for the splendid meal.

Forbes said, “We owe Owen a great deal, gentlemen. Dr. Mantell and Professor Buckland thought of their discoveries as overgrown lizards. But in the 1830s, more bones of these huge reptiles were found, and Owen studied them closely.

“The Professor has a great understanding of skeletons.



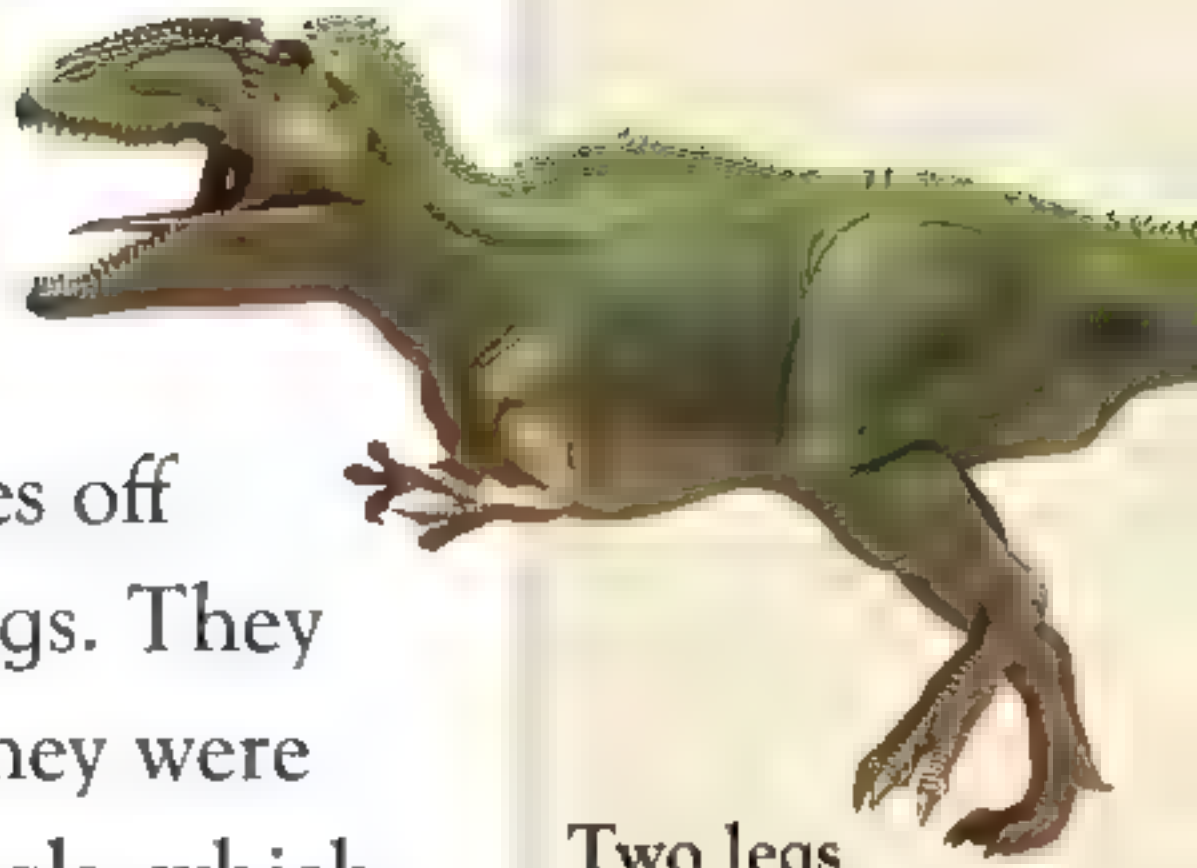


He could see that, unlike lizards, these creatures held their bodies off the ground on straight legs. They were not giant lizards. They were a separate group of animals, which Owen has named *Dinosauria*.

And now, if I may," Forbes added, "I would like to read you a poem that I have written. It is about this magnificent *Iguanodon* in which we are sitting.

*A thousand ages underground  
His skeleton had lain;  
But now his body's big  
and round  
And he's himself again!  
The jolly old beast  
Is not deceased,  
There's life in him again!"*

At this, we all let out a huge roar like a bellowing herd of *Iguanodons*. ❖



Two legs or four?  
Owen mistakenly believed that all dinosaurs walked on four legs. Later finds showed that many walked on their hind legs, like this *Giganotosaurus*.



**Dinosaurs**  
In 1841, Owen invented the name "dinosaur." It means "terrible lizard" in Greek.



**Expeditions**  
In the 1870s,  
Othniel  
Charles Marsh  
(1831–99) led  
his students  
on four  
fossil-hunting  
expeditions  
to the West.



**Railroad**  
In the 1860s,  
the Union  
Pacific Railroad  
was built across  
the U.S.A., to  
link the cities  
of the East  
with the West.



# The bone hunters

My name is Matthew Randall,  
but all my friends call me Matty.  
Let me tell you about my young days  
out in America's Wild West.

Back in 1868, I found work on  
the building of the Union Pacific  
Railroad. Laying those iron rails  
was hard work, and it was  
dangerous too.





This was the homeland of the Sioux Indians, who hated the railroad. Without the protection of the U.S. cavalry, we wouldn't have lasted very long.

For months on end, we lived on fried buffalo steaks, provided by our own hunter, "Buffalo Bill" Cody.

One day, a group of strangers rode into our camp. There were about a dozen youngsters led by an older fellow, who was short and plump.

"Good day," said the older man. "I am Professor Marsh of Yale University, and these are my students. We are on a bone-hunting expedition!"

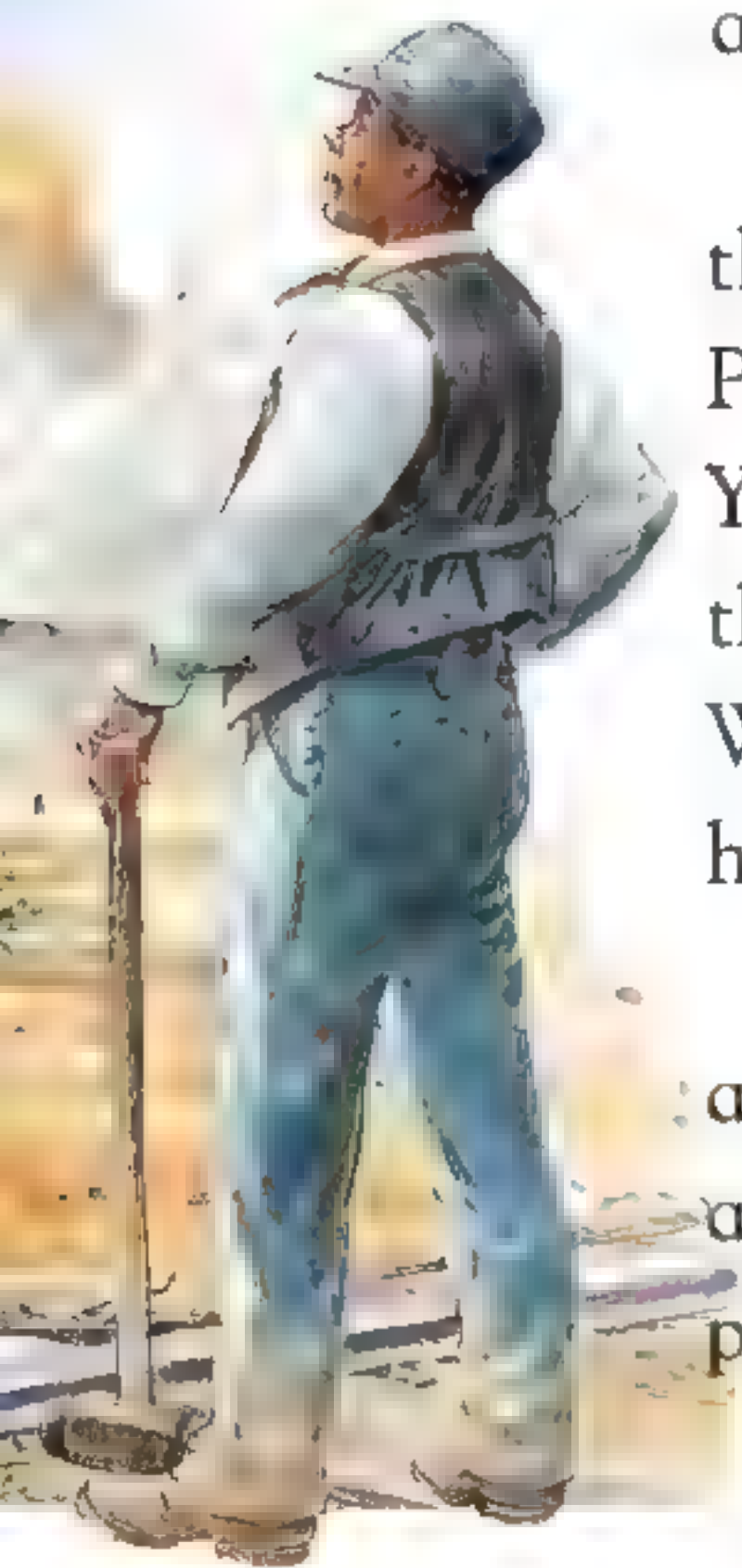
This struck me as an odd occupation, although I was too polite to say so.



**Buffalo Bill**  
William Cody earned his nickname by supplying the railway workers with buffalo meat. He was famous for his skill as a scout.



**Sioux**  
The Sioux depended on buffalo for food, clothes, tools, and tents. The settlers and railroad ruined Sioux hunting grounds.





## Museum

Marsh was the nephew of millionaire banker, George Peabody. He used his uncle's money to build the Peabody Museum at Yale, to house his fossils.



## Darwin

In 1859, Charles Darwin suggested that animals are not fixed in one permanent form, or species. They change over time, to produce new species. He called this "evolution."

The professor had come to our camp to meet up with Buffalo Bill, who had offered to be his guide on the bone-hunting expedition.

Next morning, the bone-hunters rode off. Buffalo Bill led the way and Marsh rode beside him. They had an escort of cavalymen and six wagons. We wished them well and then went back to our work on the railroad.

More than a month later, we met up with the professor again. His students now looked like real westerners, with tanned faces and well-worn clothing.

Marsh was full of stories of his adventures. He said that he'd shot an angry bull buffalo which was charging at him. He'd also made friends with some Sioux, who called him "Big Bone Chief."

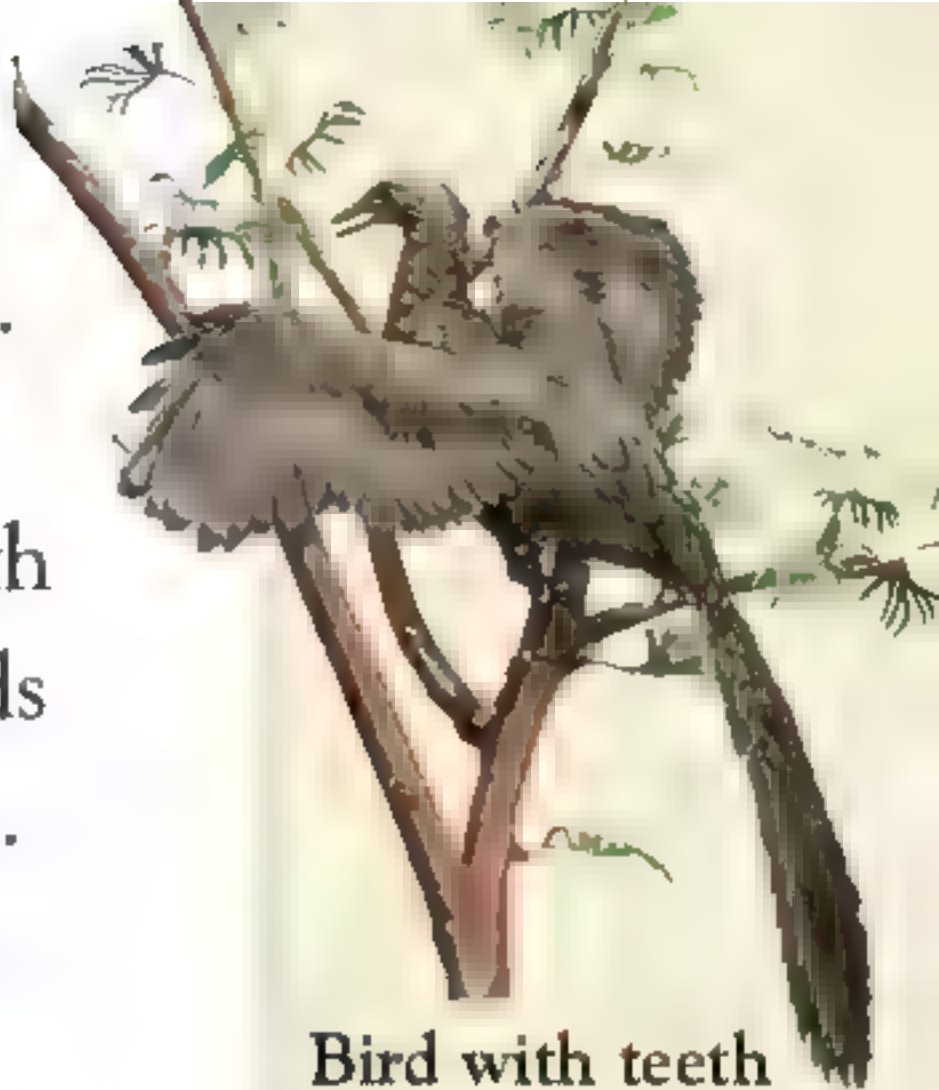
Then he showed us the wagonloads of bones he'd collected.



He handed one of them around.

“Here’s a real treasure,” he said. “It’s a bird’s skull with teeth in its beak! This shows that birds must have evolved from reptiles. It proves that Darwin was right about evolution!”

We had no idea what he was talking about.



**Bird with teeth**

Darwin’s followers believed that one group of dinosaurs grew feathers and took to the air. They evolved into birds. Early birds kept some reptile features, such as teeth.



### **Proof**

Darwin’s supporters hoped to find fossils that would prove his theory. This was why Marsh was excited to find a bird’s skull with teeth.





### Headdress

Sioux warriors wore eagle feather headdresses.

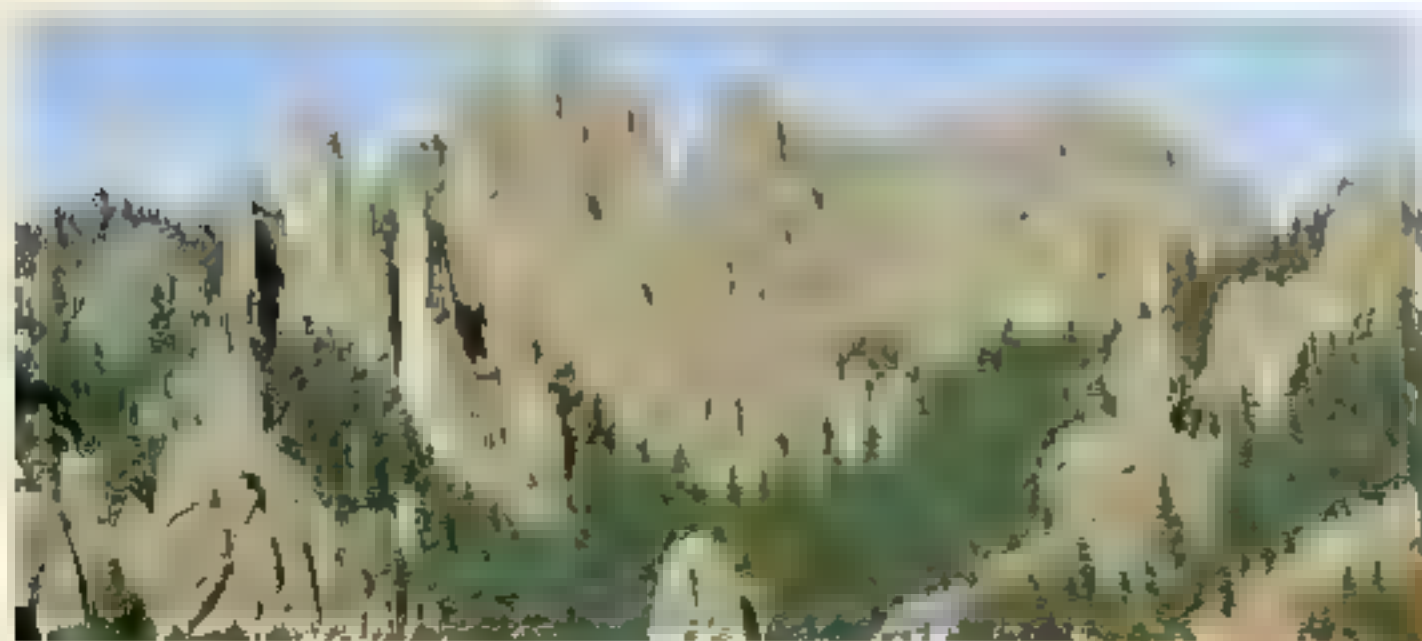
### Black Hills

The Sioux fought for the Black Hills. They won a victory at the Battle of the Little Bighorn in 1877, but eventually they lost their territory.

The professor said that if we ever found any strange bones, we should write to him at Yale. Then he went home with his students and his collection of bones. I guessed that this was the last I would hear of bone-hunting.

Over the next years, big changes came to the West. The railroads I helped to build brought thousands of settlers from the East. New towns sprang up all over the place.

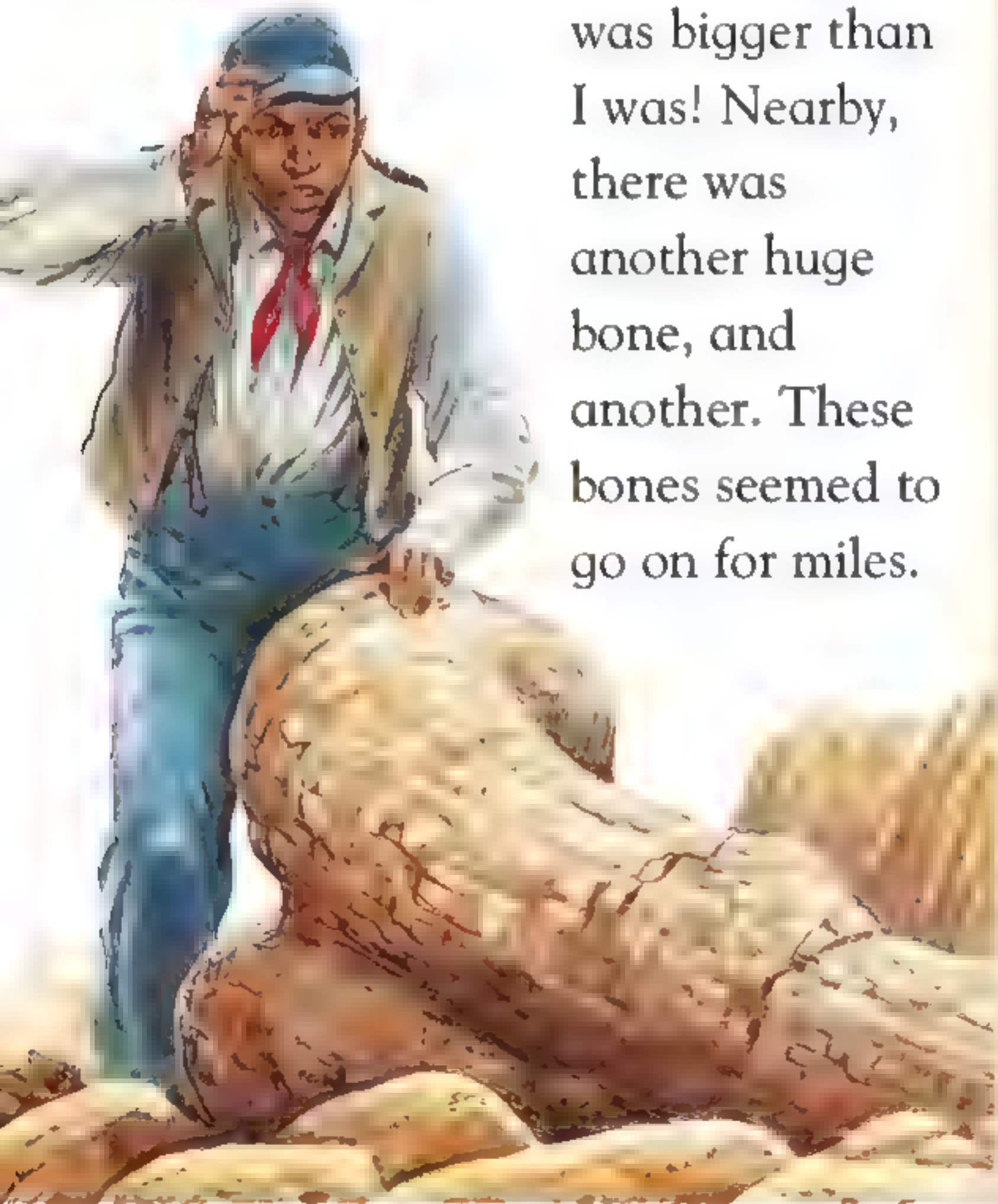
In 1874, gold was discovered in the Black Hills in Sioux territory. Soon, we had a real gold rush, with trainloads of easterners arriving, all hoping to strike it rich. The Sioux fought to defend their land, but were forced to move to reservations.





I'd found a job looking after the train depot at a little place called Como Bluff in Wyoming. I had plenty of free time and I'd often walk up into the hills. There wasn't much to look at there – just a lot of dry, bare rocks.

But one day in 1877, I found a bone sticking out of the rocks that was bigger than I was! Nearby, there was another huge bone, and another. These bones seemed to go on for miles.



### **Teepees**

Before they were forced to stay on reservations, the Sioux made good use of portable homes called teepees. These were made of buffalo hide stretched over wooden poles.

### **Bare rocks**

The rocky hills of Wyoming have been worn away by rivers, rain, and wind. These areas, called badlands, are wonderful places to find fossils.





**Cope**  
Edward  
Drinker Cope  
(1840–97)  
wrote over  
1,400 books  
and articles  
and named  
more than a  
1,000 new  
animal species.

**Spies**  
Both Marsh  
and Cope hired  
spies to keep an  
eye on what the  
other one was  
doing. They  
also used bribes  
to win over  
diggers from  
the rival  
team.

I was going to send a letter to Marsh, but then I heard that a rich bone-hunting professor had arrived in Canon City, not far away.

I traveled there, expecting to find Marsh. But I was surprised to see a different fellow. He said his name was Edward Drinker Cope.

I asked him if he knew Marsh. “Marsh!” shouted Cope, turning red in the face. “The man is a fraud and a thief!” It seemed that Cope hated Marsh worse than poison.

When I told him about the bones I had found, he offered me \$100.





I had to show him the place, and keep it a secret from Marsh's spies.

Cope soon had a team of diggers at work, blasting the rock with gunpowder and prying the bones out with crowbars. Many bones shattered and were thrown away.

But Cope couldn't keep his secret for ever. One day a team of Marsh's diggers showed up. It was just like the days of the gold rush, only these fellows were after bones. ❖

#### **Broken bones**

Eventually the diggers invented ways to protect the bones they dug up. Marsh's men wrapped them in strips of cloth, soaked in flour and water. Cope's men used boiled rice instead of flour.

#### **Useful technique**

The practice of wrapping fossils in cloth and plaster of Paris is still used on some digs today.





## Feud

Marsh and Cope fell out when Marsh pointed out that Cope had reconstructed a sea reptile with its head on the end of its tail. This humiliated Cope, who never forgave Marsh.

## Heavy reptile

*Barosaurus* belonged to the sauropod family of dinosaurs, which were the largest animals ever to walk the Earth.

# The great bone rush

Cope and Marsh each had teams of diggers working all over the West. It was a race to describe and name the new species. As a result of this “bone rush,” they discovered almost 130 new kinds of dinosaur.

Cope worked alone, but Marsh had a team of expert assistants to help him put the skeletons together.

Marsh’s dinosaurs came in many shapes and sizes. There was the flesh-eating *Allosaurus* (“different reptile”) and gigantic plant-eaters like the *Barosaurus* (“heavy reptile”).



*Triceratops*



There were also dinosaurs with horns, such as the *Triceratops* (“three-horned face”).

The strangest dinosaur of all was one Marsh called *Stegosaurus* (“roofed reptile”). It had rows of mysterious bony plates all along its back.

Meanwhile, Cope and Marsh attacked each other in newspaper articles. Their squabbling made both of them look silly, but it also made “dinosaur” a household word. ❖

**Roofed reptile**  
Scientists still argue about what the *Stegosaurus* used its plates for. Some think they helped the animal control its temperature. Others believe they were used to signal to other dinosaurs.



*Allosaurus*

*Stegosaurus*





**Life's work**  
Werner Janensch (1878–1969) spent the rest of his life working on the bones he brought back from Africa.

**Leg bone**  
*Brachiosaurus* was so big that its femur (upper leg bone) was as long as a person!



# The biggest bone dig

My name is Dr. Werner Janensch. I've just come home to Germany after spending three years in Africa, leading a huge dig.

Back in 1907, I heard that some giant bones had been found at a place called Tendugaru in East Africa. I raised the money for an expedition and sailed to Africa in 1909.

I hired hundreds of local workers to do the digging. Tendugaru lies far inland, and there are no roads. All our food and supplies had to be carried on foot from the coast. The bones we dug up had to be carried back in the same way.

I was expecting to find new dinosaurs in Africa.





We've come back with more than 80,000 dinosaur bones. Now I've got to try to sort them out!

The baffling thing is that my bones belong to the *Brachiosaurus* and other species that have also been found in America. Africa and America are separated by the wide Atlantic Ocean. How did these lumbering beasts get from one continent to the other?

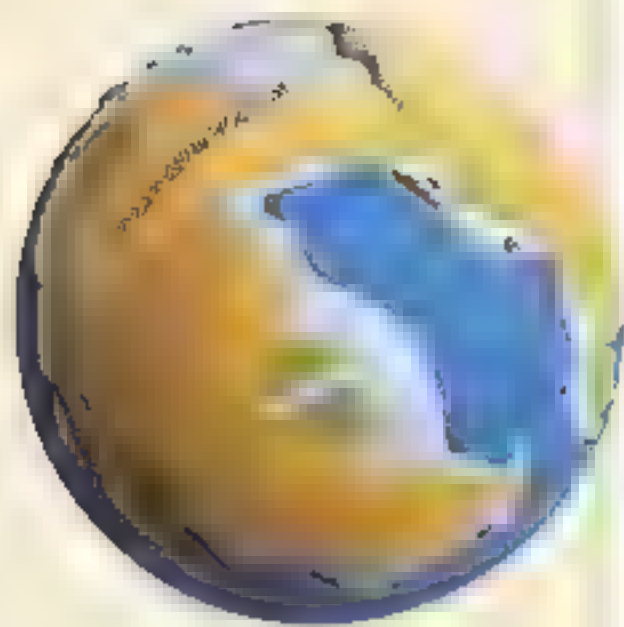


*Brachiosaurus*

Janensch's *Brachiosaurus* is now on display in Berlin. At 39 feet (11.8 meters) high and 74 feet (22.5 meters) long, it is the world's largest complete dinosaur skeleton.







### Wegener

In 1912, Alfred Wegener suggested that there was once only one huge land mass which he called "Pangaea." He believed that it had split into pieces. The pieces slowly drifted apart to form the continents that we know today.

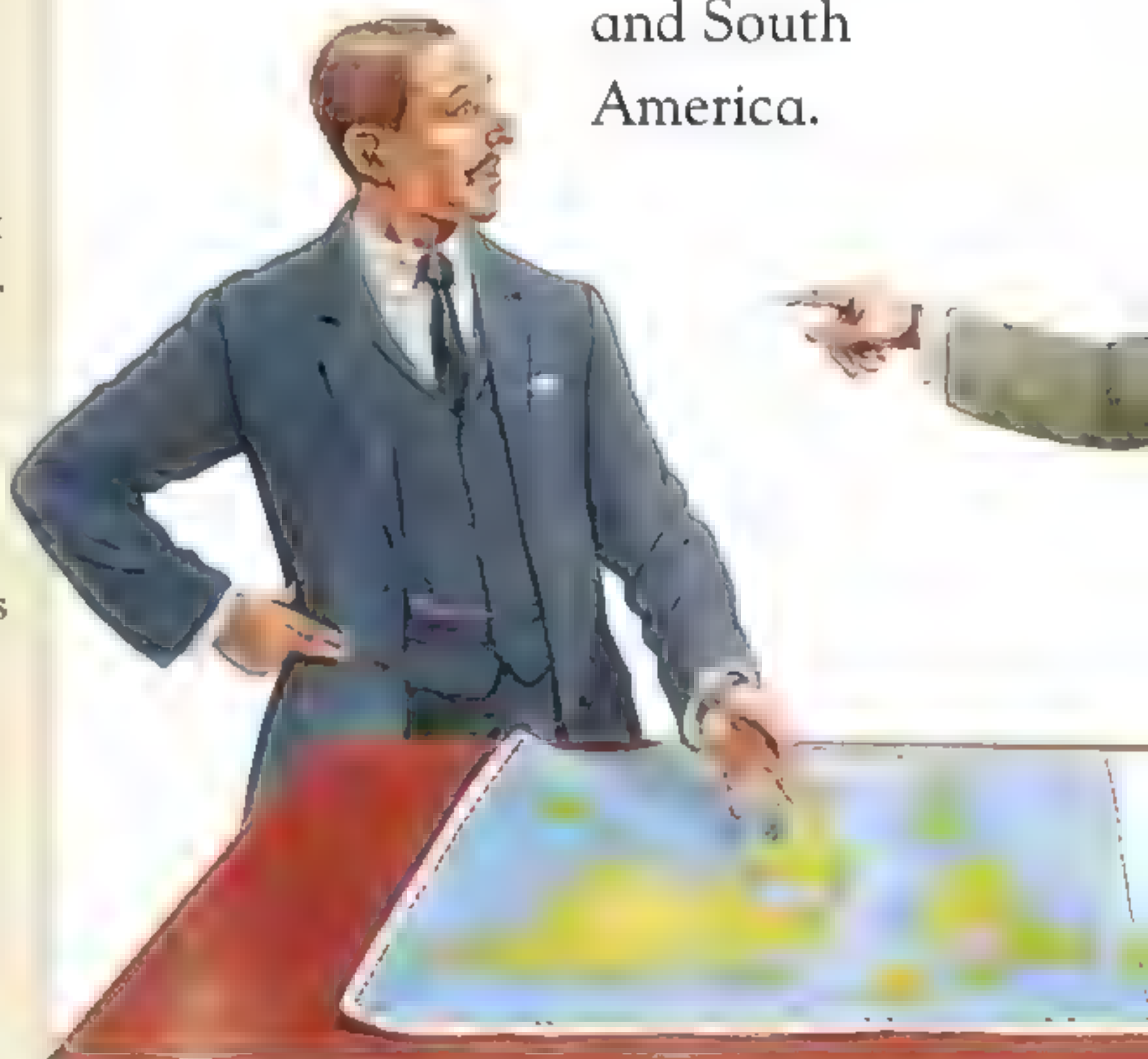
### Wild theory

At the time, few scientists took Wegener's theory of "continental drift" seriously. It was not until the 1960s that he was proved right.

In Berlin, I showed my *Brachiosaurus* skull to some of our geologists. "This is an American dinosaur," I explained. "How did it end up in Africa? It's a mystery!"

Most of them were puzzled. But a young man called Alfred Wegener said, "It's not a mystery at all. This is exactly the type of dinosaur I would expect to find in Africa!"

Wegener pulled out a world map. "Look at the coastlines of Africa and South America.





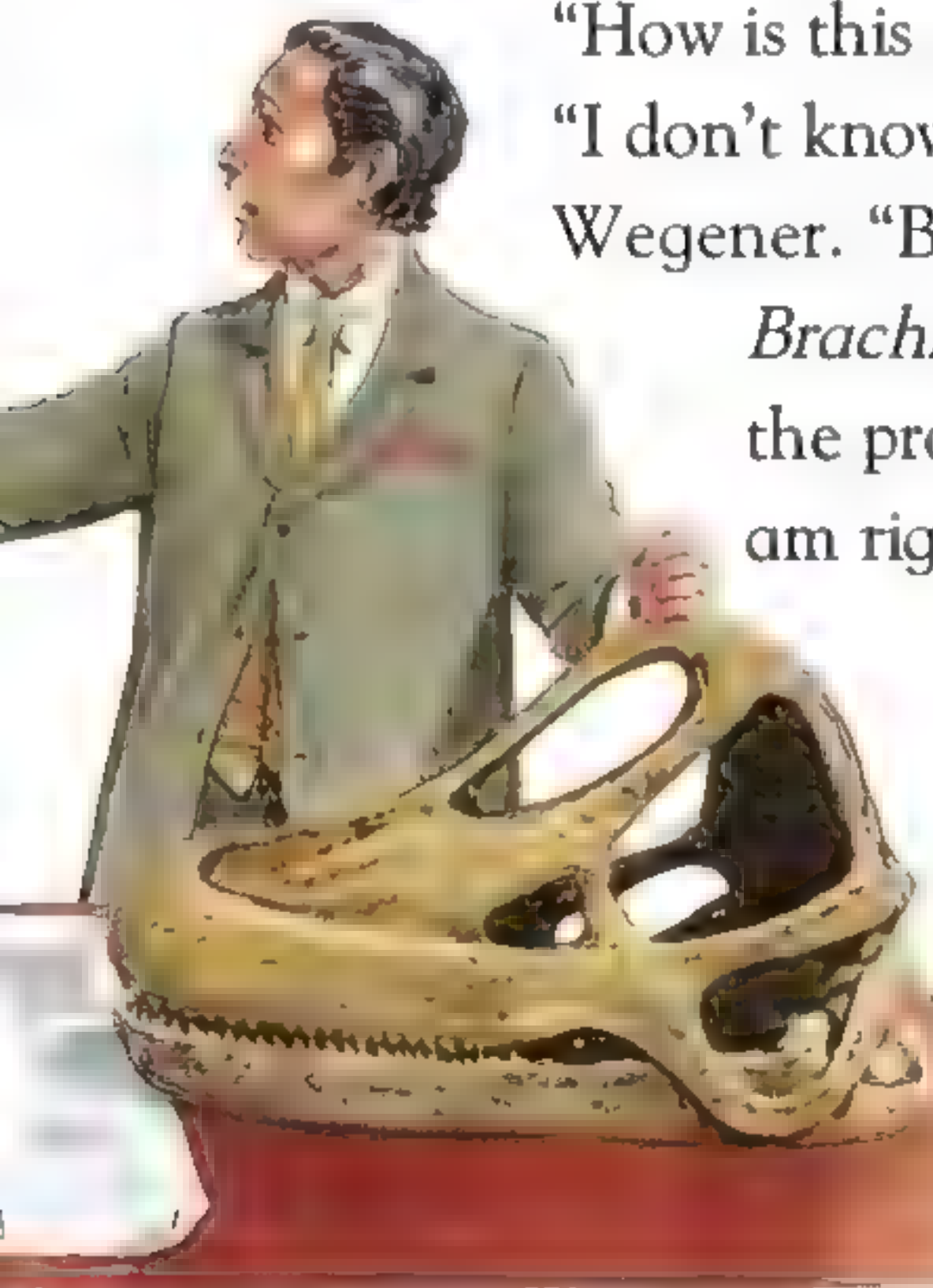
Their shapes match exactly. I believe that they must have once been joined. Somehow, they have drifted to their present positions.

This is why you found the same dinosaurs in Africa and America. When your *Brachiosaurus* was alive, there was no Atlantic Ocean!"

We were all startled by this wild theory. "Are you seriously suggesting that continents can roam around the Earth's surface?" I asked.

"How is this possible?"

"I don't know," said Wegener. "But your *Brachiosaurus* is the proof that I am right!" ❖

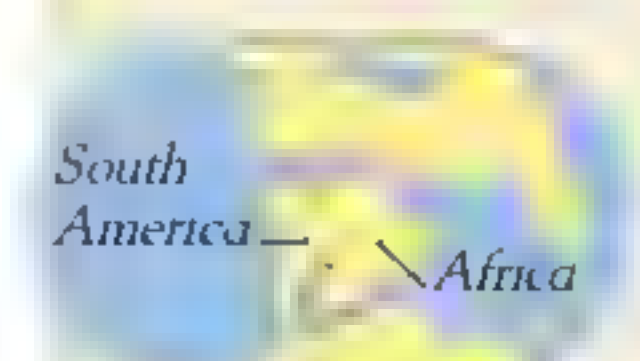


### Drifting continents

We now know that the Earth's surface is made up of several enormous plates floating on top of molten rock. Forces inside the Earth move the plates slowly. This is what made the continents move and split apart.



270 million years ago



130 million years ago



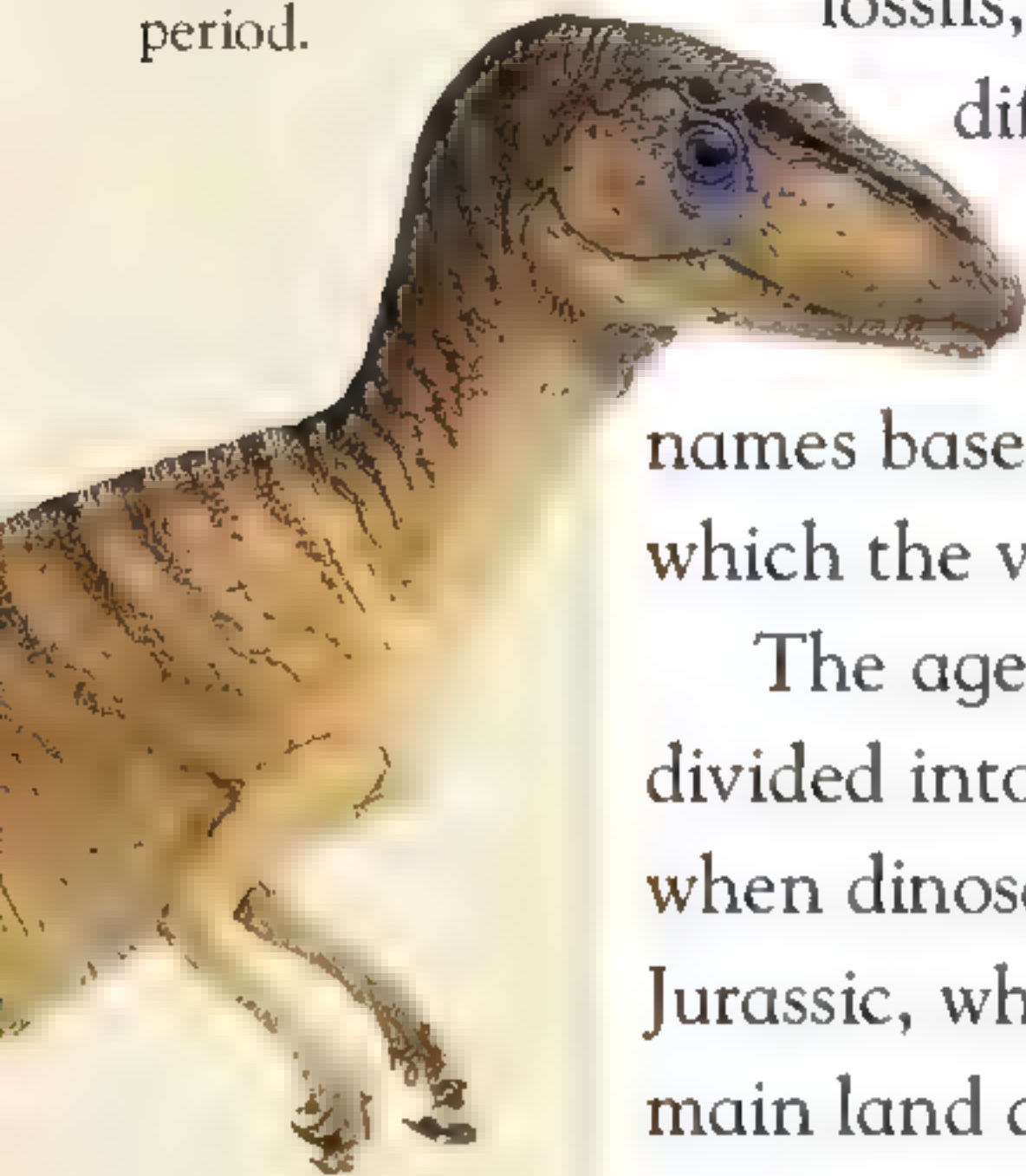
Present day



## Triassic

(248–205 million years ago)

Early dinosaurs, like this small *Herrerasaurus*, evolved in the Triassic period.



# Dating the dinosaurs

Like detectives, early geologists collected evidence to piece together the story of life on Earth. Using fossils, they were able to place different periods of the

Earth's history in order.

They gave these periods names based on the type of rocks in which the various fossils were found.

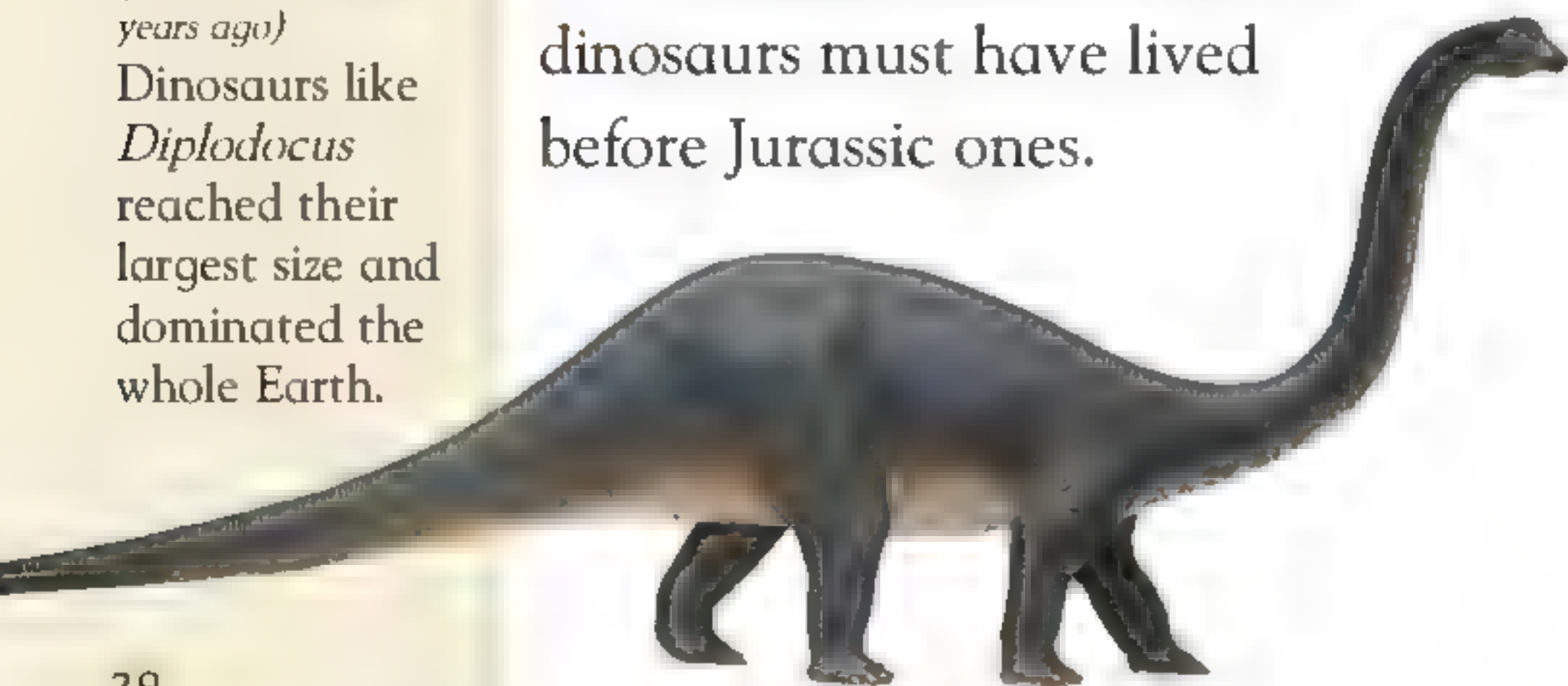
The age of the dinosaurs was divided into three periods: Triassic, when dinosaurs first evolved; Jurassic, when they became the main land animals; and Cretaceous, when new sorts, such as the horned dinosaurs, appeared.

Geologists knew that Triassic dinosaurs must have lived before Jurassic ones.

## Jurassic

(205–144 million years ago)

Dinosaurs like *Diplodocus* reached their largest size and dominated the whole Earth.





But they could only guess how long ago that was.

It was not until the 1920s that scientists were able to work out the age of rocks. This was thanks to the study of radioactivity.

Many rocks are made up of elements which are radioactive. These elements slowly decay, or break down, to form other elements. Scientists measure the amount of a radioactive element in a rock. They can then work out how long the decay has been going on and so when the rock was formed.

Radioactive decay is like a clock, ticking away inside the Earth's rocks. Using this clock, scientists were able to date the rocks holding the dinosaur fossils.

This told them when the dinosaurs had lived. ❖

**Cretaceous**  
(144–65 million years ago)

This was the age of the horned dinosaurs, such as this *Protoceratops*.



### Elements

Elements are the basic substances, such as carbon and iron, that all things are made of. Radioactive elements include potassium and uranium.





**Jack Horner**  
Dr. Jack Horner (1946–) is one of the world's leading experts on dinosaurs. He was the technical adviser for the films *Jurassic Park* and *The Lost World*.

**Paleontology**  
A modern dinosaur detective is called a paleontologist. Paleontology is the study of ancient life. It comes from the Greek word, *palaios*, which means "ancient."

## Baby dinosaurs

In 1978, a paleontologist named Jack Horner was visiting a fossil shop in Montana, U.S.A. He found the bones of a baby dinosaur. This was an important discovery. Few baby dinosaurs had ever been found!

Horner traced the fossil back to the rocky hillside where it had been discovered, and began to dig. Soon he had uncovered a huge nest. It was over 6 feet (2 meters) wide and contained 15 baby dinosaurs and lots of crushed eggshells.

In the 1980s, Horner's team found more nests at the site. Some of them contained eggs and newly hatched babies.

Horner knew that the soil around the nests could hold clues.





By sifting the soil and examining it under a microscope, he discovered the remains of chewed up leaves and berries. He also found dinosaur droppings, containing woody debris from conifer trees. Can you work out what he discovered?

Horner used these clues and other evidence to build an amazing picture of the lives of these dinosaurs.



Fossilized baby Horner's team chipped away the rock to discover this fossilized eggshell containing a baby hatchling.







### Herds

Fossil footprints are further evidence that some dinosaurs, such as these *Gallimimus*, traveled in herds. The young stayed in the middle of a herd, while the adults walked on either side, for protection.

Jack Horner's most important discovery was that the babies were being looked after by their parents. He called this dinosaur *Maiasaura*, which means "good mother lizard."

The evidence for parental care was the size of the 15 babies. Since they were three times bigger than newly hatched ones, they must have stayed in their nest for weeks after hatching.





They had crushed the eggshells in their nest as they moved around. The chewed up leaves and berries were food brought by the parents.

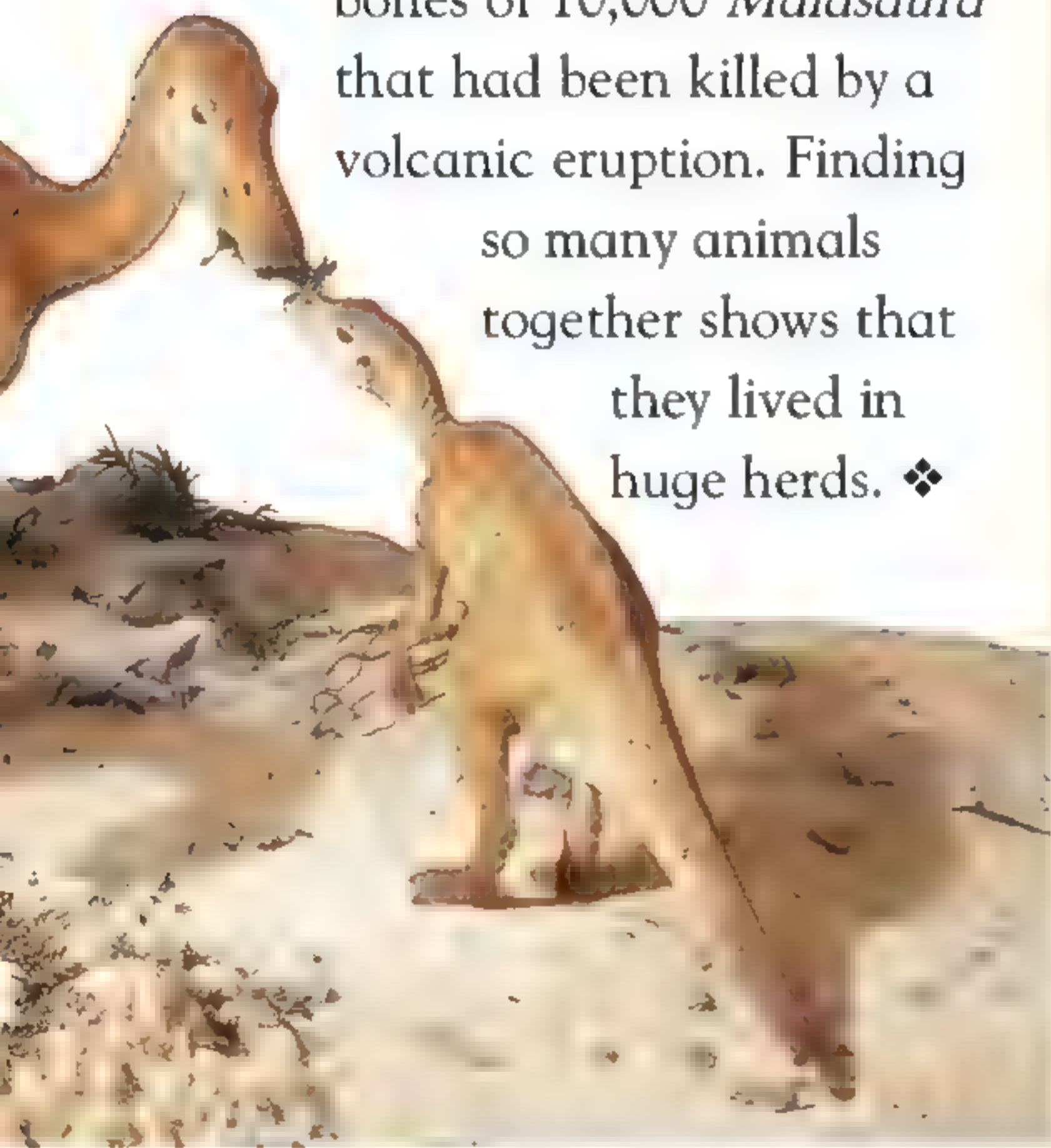
The mystery is why the babies died. Perhaps something happened to their parents and the babies starved to death in the nest.

In 1984, Horner's team made another discovery. They found the bones of 10,000 *Maiasaura* that had been killed by a volcanic eruption. Finding so many animals together shows that they lived in huge herds. ❖



**Like modern animals**  
Jack Horner says, "Dinosaurs basically aren't any different from animals alive today. They just looked different."

**Nest site**  
Horner thinks that these *Maiasaura* returned to the same nest site year after year, just like many birds and turtles do today.



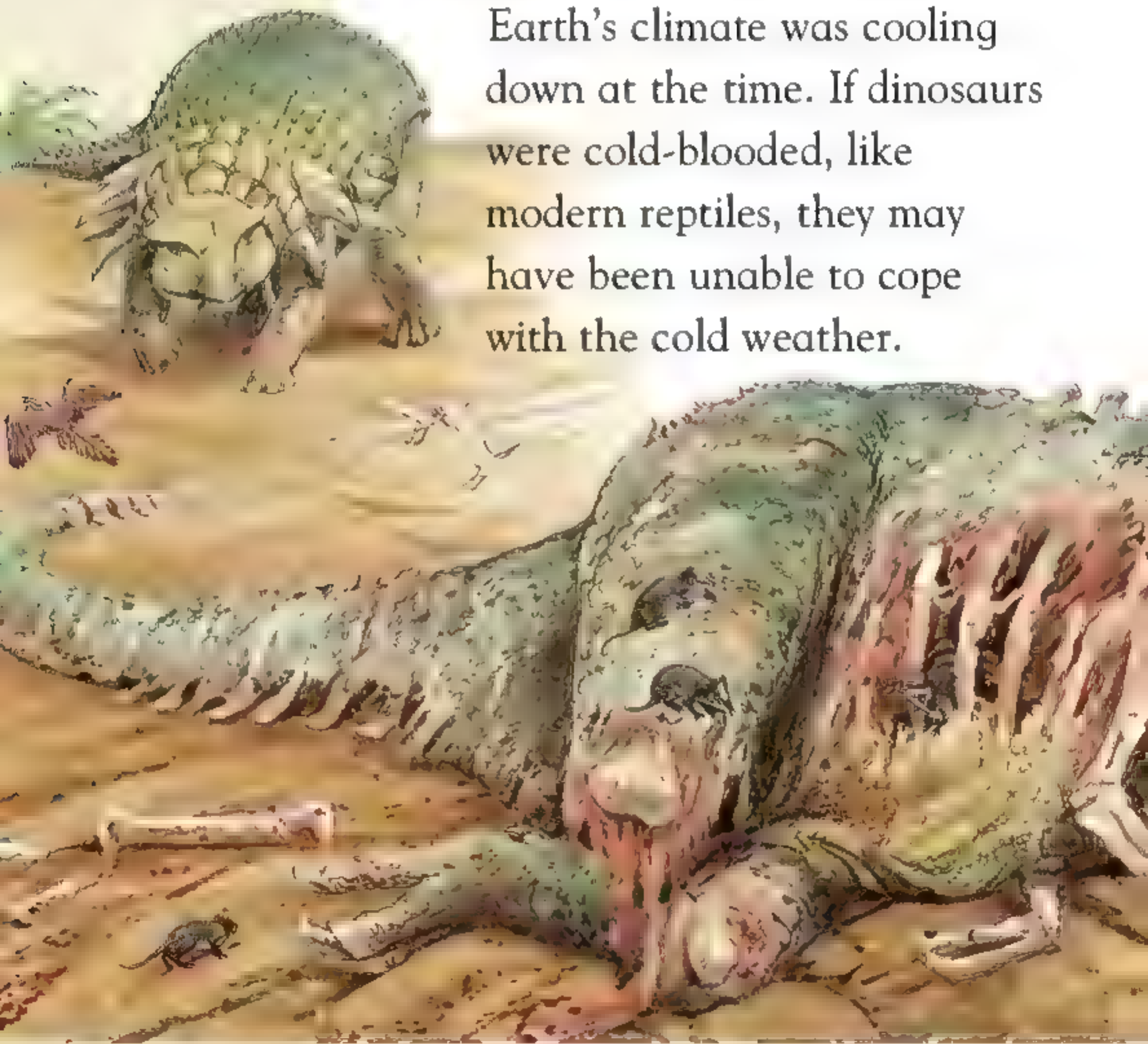


**Cold-blooded**  
Lizards and  
other cold-  
blooded  
animals depend  
on outside heat  
to control  
their body  
temperature.  
They have to  
bask in the  
sunshine to  
warm up.

## End of the dinosaurs

Sixty-five million years ago,  
the dinosaurs disappeared. No  
one knows for certain why this  
happened, nor why some other  
animals, such as mammals and  
fish, survived.

Scientists do know that the  
Earth's climate was cooling  
down at the time. If dinosaurs  
were cold-blooded, like  
modern reptiles, they may  
have been unable to cope  
with the cold weather.





Warm-blooded mammals could have taken over.

In 1990, a huge crater about 124 miles (200 kilometers) across was found on the seabed off Mexico. It was formed 65 million years ago when a massive object, such as an meteorite, crashed into the Earth.

The impact of such a large meteorite would throw up a huge cloud of dust and gases. This would block out the Sun's light for months. Without sunlight, plants would die, followed by the animals that ate them. Perhaps this is what led to the end of the dinosaurs. ❖



Warm-blooded People, lemurs, and other warm-blooded animals control their body temperature by converting food into heat. They need more food than cold-blooded animals.



**Meteorites**  
Meteorites are rocks which hurtle through space, occasionally smashing into the Earth.





## *Tyrannosaurus rex*

*T.rex* ("king tyrant lizard") was a huge meat-eating dinosaur, up to 20 feet (6 meters) high and 40 feet (12 meters) long. It lived in the late Cretaceous period.



### Smell

*T.rex* used its sense of smell to track down food – either living animals to hunt, or animals that had already died.



## Today's detectives

When Mary Anning went fossil hunting, her only equipment was a geological hammer. But today's dinosaur detectives have many more tools at their disposal.

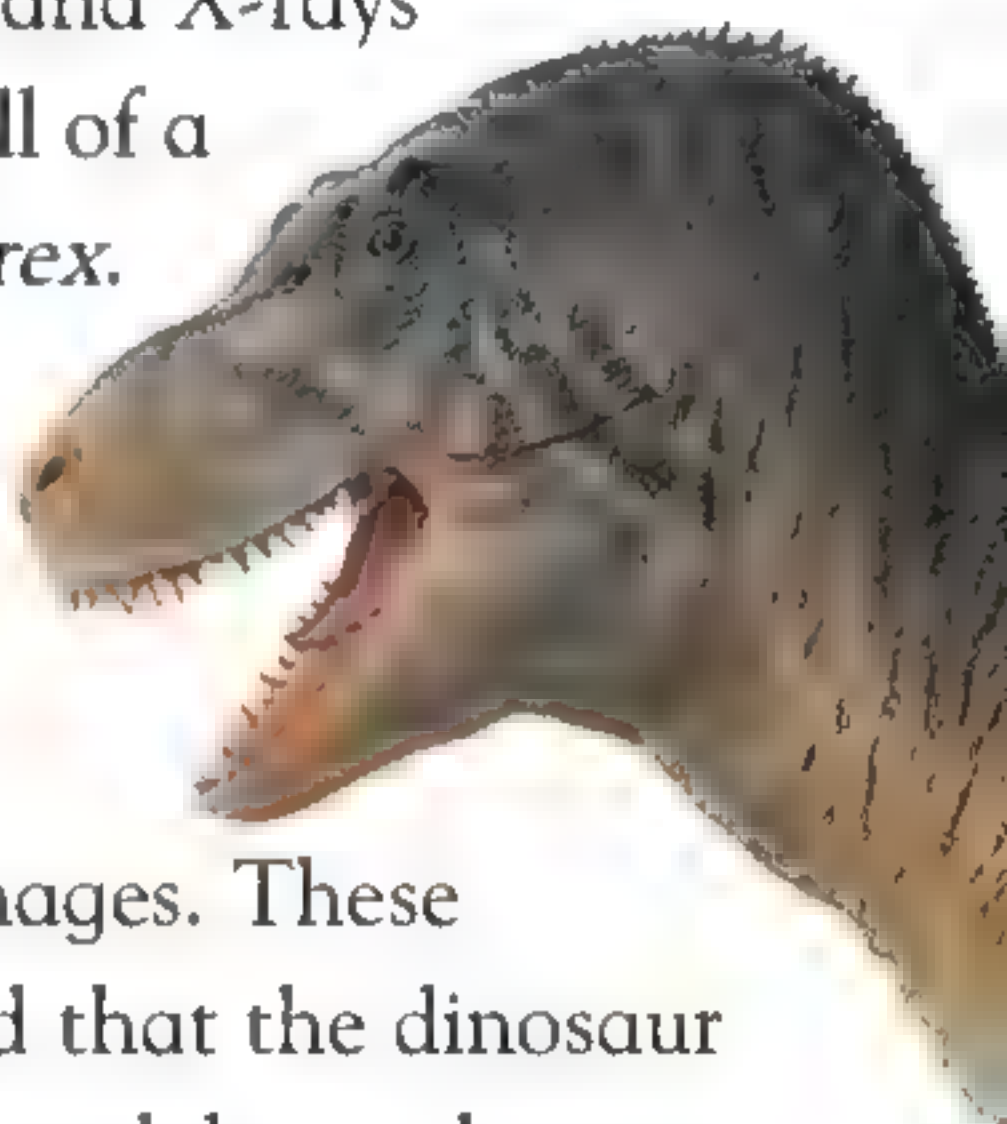
In 1998, scientists in California used computers and X-rays to study the skull of a *Tyrannosaurus rex*.

They scanned it for 500 hours.

They produced hundreds of

computerized images. These pictures revealed that the dinosaur had huge olfactory lobes – the parts of the brain used for smell. *T.rex* clearly had a powerful nose!

Dinosaur modeling has come a long way since the concrete *Iguanodon* in 1853. Today, experts examine fossils for marks where muscles were attached.





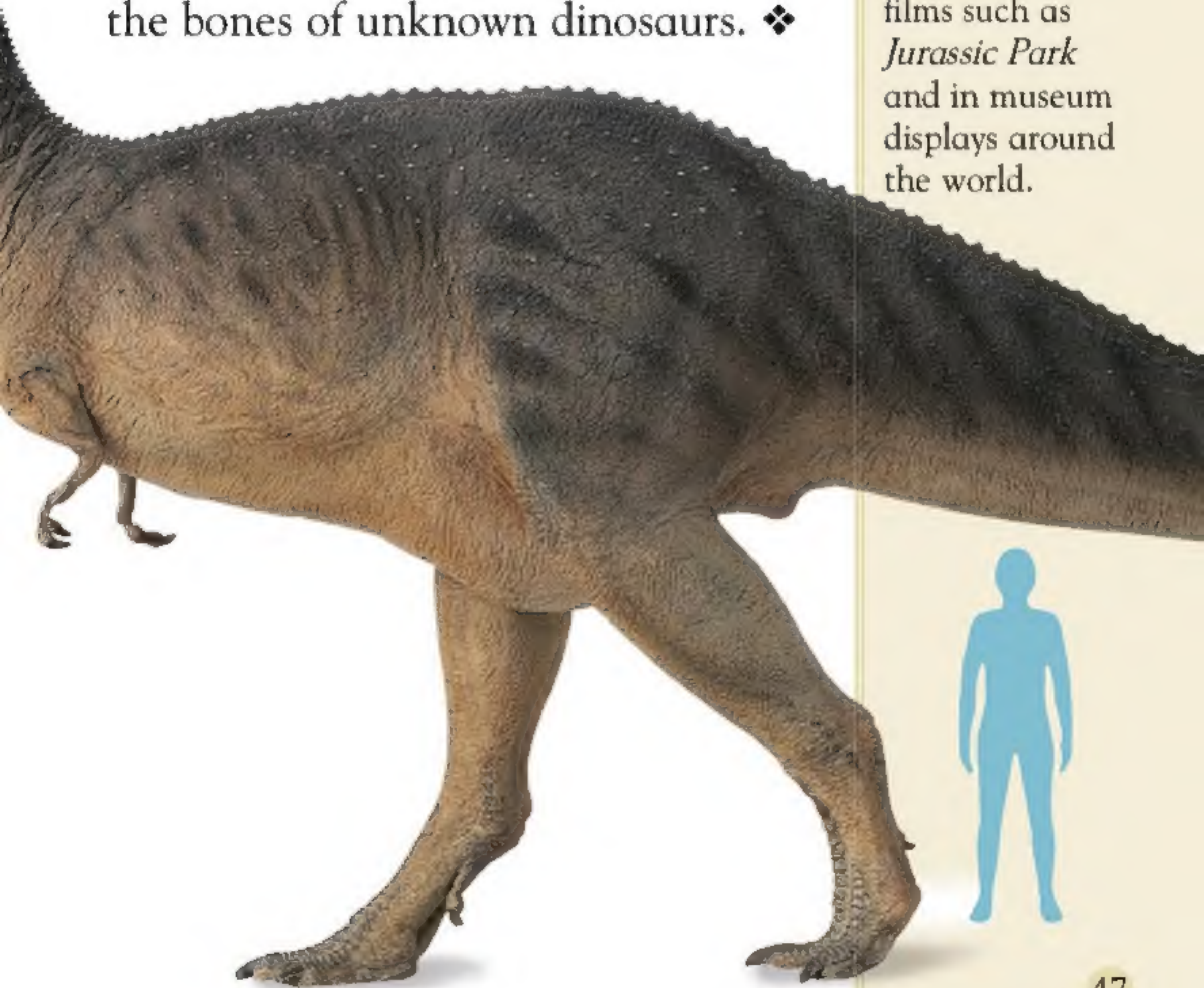
These show the modelers how to shape the body and how the animal moved. Even so, much is guesswork: fossils can't show us the color of skin or eyes.

People are still hunting for dinosaurs and new species are being discovered. Perhaps, lying in the rocks beneath your feet, there are the bones of unknown dinosaurs. ❖



### Computers

Thanks to computer animation, we can see how dinosaurs moved in films such as *Jurassic Park* and in museum displays around the world.





# Glossary

**Ammonite**

A prehistoric sea creature with a coiled shell.

Ammonites are among the most common fossils.

**Cold-blooded**

To have a body temperature that varies with the surroundings. Reptiles and fish are cold-blooded.

**Continental drift**

The theory that the continents were once joined together, but split apart and slowly drifted to their present positions.

**Cretaceous**

The third period in the age of the dinosaurs, 144–65 million years ago.

**Dinosaurs**

Land reptiles that lived between 248–65 million years ago. Many dinosaurs were very big. The name dinosaur means “terrible lizard” in Greek.

**Elements**

The basic substances, such as hydrogen, carbon, and iron, that all things are made of.

**Evolution**

The theory that species of animals and plants gradually change over long periods of time to produce new species.

**Extinction**

The complete dying out of a species.

**Fossils**

Traces of animals and plants, preserved in rocks. Fossils include bones, skin, and footprints. The name means “dug up” in Latin.

**Geology**

The study of the Earth and its rocks.

**Jurassic**

The second period in the age of the dinosaurs, 205–144 million years ago.

**Mammals**

A group of warm-blooded animals with hair. Mammals give birth to live young, which they feed on milk. Mice, whales, horses, and humans are mammals.

**Meteorites**

Large rocks that hurtle through space and occasionally smash into the Earth.

**Naturalist**

A scientist who studies animals and plants.

**Paleontology**

The study of ancient life, from the Greek word, *palaios*, which means “ancient.”

**Pterosaurs**

Flying reptiles that lived at the same time as the dinosaurs.

**Quarry**

A place where stone is dug out of the ground.

**Radioactivity**

The energy released by elements, such as uranium, as they slowly break down, or decay. Radioactivity can be used to date rocks.

**Reptiles**

A group of cold-blooded, egg-laying animals with scaly skins. They include lizards, snakes, tortoises, and crocodiles.

**Sauropods**

A group of huge, long-necked dinosaurs that included *Barosaurus*.

**Species**

A group of animals or plants that can breed together and that differ only in minor details.

**Triassic**

The first period in the age of the dinosaurs, 248–205 million years ago.

**Warm-blooded**

To have a body that stays constantly warm. Mammals are warm-blooded.



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